The Chemical Age

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More Planning for Depressed Areas

THE needs of the depressed areas are clamant. It cannot be said with truth that the wave of trade improvement has passed them by nor that they have been unaffected by the general improvement. There has been some amelioration, and in some types of work, such as that of steel production, output is back at prosperity level. It cannot be denied, however, that the country as a whole is faced with the problem of doing something to alleviate permanently the distress in those areas. The depressed areas are those that are based upon coal. The depression has resulted from the unwillingness, or the inability, of the employers and workmen to find other outlets for their brains and hands. It is not a problem that can be solved by any one direct method. The essentials are briefly that those resident in the area shall be trained to take up other employment and that other employment shall be made available by attracting new industries. Each depressed area must work out its own salvation.

One of the most energetic of the areas is that of Durham, and some instructive speeches were made at a recent meeting of the South-West Durham Development Board. It is agreed that the condition of these areas was due in the first instance to the decline in the demand for coal. But is it true, as Lord Londonderry claimed, that the coal industry is prevented from reviving by the necessity for decreased production, by the greater use of electricity, and by the diminution of shipping requirements? To-day, in many industries the quantities of manufactured goods that are being made are greater than ever before. The efficiency of power generation in electrical generating stations is low; the very best that can be done is an overall thermal efficiency of well below 30 per cent. During the 21 years ending in 1934 the drop in the amount of bunker coal was less than 8,000,000 tons. The fact is, of course, that the efficiency of use of coal has improved vastly in all industries, including that of power generation. For this reason only 11.4 million tons of coal were used in power stations in 1934 as compared with 29 million tons that would have been used if the efficiency had remained as in 1910. All other power- and fuel-using industries have the same story to tell, and the march of science has been responsible for the transformation of a prosperous countryside into a depressed area.

Not only are the areas depressed, but they are in too many instances depressing. The Board recognised that unless the country was made attractive those starting new ventures would not be attracted. It is a principle which holds in individual factories as well as throughout the countryside. The Board wisely agreed that since the district was derelict, "it is essential as a first step to recovery that the general appearance should be improved, better housing and sanitary conditions should be provided . . ." and so forth. In other words, make the shop attractive and people will come to it. A review of the debate, however, reveals that—so far as the speeches have been reported—the minds of those who have to deal with the problem do not get very far beyond coal. Many speakers and especially Members of Parliament stressed the oil-from-coal proposal as the means for bringing back prosperity. Oil from coal is all very well in its way, but it is not enough, and if petroleum is found in paying quantities in this country, it is doubtful whether any considerable development along those lines will not ultimately cause those districts to return to their depressed condition. Undoubtedly some means must be found of escaping from the vicious rates circle. If these stricken districts were made more attractive financially, if their communications were improved by railway electrification, if the amenities were improved so that they became attractive places in which to live, manufacturers would come unsought.

Dr. Dalton insisted that there should be a wider dispersion of industry. The chemical industry is perhaps the most widespread of all, save agriculture. Chemical manufacturers have never hesitated to put their factories in the less pleasant places of the earth. There should be less insistence upon coal and fuel industries for the depressed areas. New chemical manufactures are springing up all over the world; cannot we establish some of these in our depressed areas? Professor Bergius, for example, has just described new developments in the chemistry of lignin and wood; it is now possible to decompose wood so that two-thirds of it is obtained in the form of raw wood sugar, the other third being lignin. The raw sugar is used in feeding animals so that the establishment of this process would comprise developments in forestry, agriculture and chemical manufacture—just what the depressed areas need. It is said to be possible to grow as much foodstuff when this process is in use, on an acre of woodland as on an acre of arable land. It is not possible for the miners in the depressed areas to put back the clock of progress. Science must aim at increasing efficiency and the great basic industries must cut their cloth accordingly until increased consumption of goods brings increased demand for basic materials. Lord Londonderry may have been right when he blamed the advance of scientific knowledge for the present difficulties, but it is the further application of science that will provide relief.

Notes and Comments

World Chemical Engineering

CHEMICAL engineering history will be made in Great Britain between June 22 and July 11 this year. During the first of these three weeks the Chemical Engineering Congress of the World Power Conference will be held at the Central Hall, Westminster, when every industrial country of the world will be represented. Membership application forms have been issued, and nearly forty British organisations and Government departments will combine to demonstrate to the world what Great Britain thinks of chemical engineering. The British chemical plant exhibition, arranged by the British Chemical Plant Manufacturers' Association, will be held at the same time. All the available space has been booked, and details of the exhibition are given in another page. During the second week members of the American Institute of Chemical Engineers, accompanied by members of our own Institution of Chemical Engineers and other bodies, will tour the country and see some of our principal chemical undertakings. In the third week the Society of Chemical Industry will be holding its annual meeting at Liverpool, and there again the gatherings are likely to have an international character, as a number of the overseas visitors have been invited to prolong their sojourn in England to allow of their attendance at some of the sessions. The Chemical Engineering Congress, which is a sectional meeting of the World Power Conference that had. its birth at Wembley in 1924, is the first of its kind ever held, and the wide field covered by the programme of papers is one that should serve to bring home to everyone the great importance of chemical engineering in relation to world prosperity.

Irish Chemists Get Together

CHEMISTS in Ireland have at last given practical expression to their realisation of the need for adequate appreciation of the importance of the scientific expert in industry. As reported in THE CHEMICAL AGE a fortnight ago, they have formed the Irish Chemists' Association, with objects which seem to be identical with those of the British Association of Chemists. At the inaugural meeting, Professor Thomas Dillon remarked that the chemist in Ireland, whose profession requires far more training, skill and ability than any of the so-called learned professions, is often asked to work for the wage of an unskilled labourer—a state of affairs which might have persisted in this country but for the activities of such bodies as the British Association of Chemists. The result of this unsatisfactory position, if it were allowed to continue, would be that young men of ability would not enter the chemical profession, and the country would be denuded of native technical skill of the higher kind necessary in these days for the successful direction of industry. To what extent the new Association will consider the question of professional registration we do not yet know. For the moment the emphasis is upon economic considerations. Bearing in mind the history of the British Association of Chemists, this is not surprising. The natural sequence is to deal with economic considerations first, but Irish chemists will probably find that this question is bound up with that of a closed profession and the existence of a body which speaks for the whole profession. The British Association of Chemists has welcomed the formation of the sister organisation, and we agree with the sentiment expressed in the "Chemical Practitioner" that it is desirable that relations should be established with it.

London County Council Chemist

BY the retirement on April 8 of Mr. J. H. Coste, chemist-in-chief, the London County Council has lost the services of a distinguished member of its staff. Mr. Coste entered the council's chemical and gas-testing department in 1894, and from 1908 was chief assistant to the late Dr. F. Clowes. When the chemical work was transferred to the public health department in 1913 he was appointed chemist in that department and agricultural analyst for the county of London. Mr. Coste has for many years held a very high position in the chemical world and is a writer of eminence on chemical and allied subjects. He has written numerous papers and reports concerning the treatment of sewage, the investigation of atmospheric pollution, technical gas calorimetry, turpentine and turpentine substitutes, and the determination of water in coal; at the request of the Home Office, jointly with their inspector he investigated the cause of the explosion at Mitcham, Surrey, in 1933. His services as head of the chemical laboratories, with the extensive variety of analytical and experimental work, have been of great value to the council. Mr. Coste is succeeded by Mr. E. T. Shelbourn, who has for some years been his chief assistant.

Paint Research

ARRANGEMENTS have been made for a series of "open days" at the Paint Research Station at Teddington next month, commencing on May 19, when Mr. J. Ramsay MacDonald, Lord President of the Council, will open the new building extension. Wednesday, May 20, will be devoted to assemblies of architects and decorators, May 21 to the Oil and Colour Chemists' Association, May 22 to the London Section and Plastics Group of the Society of Chemical Industry, and May 23 to the Institute of Builders. In common with other and similar research associations the Research Association of British Paint, Colour and Varnish Manufacturers, under whose auspices the research station is conducted, has for its aim the application of scientific knowledge and methods to the problems of the industries concerned, which range from paint to printing ink, pigments, varnishes, linoleum and the like. The work up to recent times has been mainly concerned with problems arising out of development and control of manufacture; but a special division has now been formed for the study of paint application problems, with a corresponding extension of interest to architects, builders and decorators. The original research work carried out at the Paint Research Station is, from time to time, set out in the form of technical papers and bulletins, of which some ninety have been issued to date. In addition, a comprehensive "Abstract Review of Current Literature in the Paint, Varnish and Allied Industries" is published.

The Chemical Society at Bristol

Professor N. V. Sidgwick's Presidential Address

THE ninety-fifth annual general meeting and the anniversary dinner of the Chemical Society was held at Bristol University on Thursday, under the presidency of Professor N. V. Sidgwick, who devoted his presidential address to the subject of "Structural Chemistry."

There are two ideas about the progress of science which are widely prevalent, and which appear to be both false and pernicious, said Professor N. V. Sidgwick. The first is the notion that when a new discovery is made it shows the previous conceptions on the subject to be untrue, from which unscientific people draw the very natural inference that if to-day's scientific ideas show those of yesterday to be wrong, we need not trouble about them because they may themselves be shown to be wrong to-morrow. The second fallacy is that the progress of research involves increasing specialisation and speculation, we are told, means knowing more and more about less and less. This last phrase has undoubtedly brought comfort to many people who know practically nothing about absolutely everything. But it is entirely untrue to suppose that the growth of scientific knowledge involves a limitation of the sphere of our scientific interests. Nothing is more remarkable about the immense development of physics and chemistry in this century than the way in which it has brought to bear on the same problems the results of the investigation of widely different properties, obtained by widely different experimental methods. These points are well illustrated by the development of structural chemistry from its origin to the present time.

Professor N. V. Sidgwick, D.Sc., F.R.S., President of the Chemical Society.

Structural chemistry was laid down in the 50's and 60's of last century, mainly by the work of Cannizzaro and Kekulé; it was extended to three dimensions by van't Hoff and Le Bel in 1874, 62 years ago. Since then, at any rate until the last three or four years, it has undergone no serious modification. One or two minor developments have been introduced: the recognition of the distinction between ionised and non-ionised links, and of the existence of the co-ordinate or semipolar link. But in essence it remains to-day what it was 60 years ago, and Cannizzaro, if he read the last (1935) volume of Richter's textbook, would find no difficulty in understanding the formulæ and the equations. This structural theory, said Professor Sidgwick, is of extreme simplicity. It assumes that the molecule is held together by links between one atom and the next; that every kind of atom can form a definite small number of such links; that they can be single, double or triple; that the groups may take up any position possible by rotation round the line of a single, but not round that of a double, link; and finally, that with all the elements of the first short period, and with many others as well, the angles between the valencies are approximately those formed by joining the centre of a regular tetrahedron to its angular points. No assumption whatever is made as to the mechanism of the linkage. Through the whole development of organic chemistry, with its quarter of a million compounds, this theory has always proved capable of providing a different structure for every different compound that can be isolated. Among the hundreds of thousands of known substances there are never more isomeric forms than the theory permits.

At the same time our knowledge of the meaning of these structures has developed, especially in the last 30 years, to an enormous extent. We have applied to their investigation a whole series of physical methods, based on the examination of absorption spectra in the infra-red, the visible, and the ultra-violet, including the Raman spectra; on the measurement of specific heats and heats of combustion; of the di-electric properties; of the scattering of X-rays and electron waves; of chemical dynamics; to mention only the most important. To Kekulé the links had no properties beyond that of linking; but we now know their lengths, their heats of formation, their resistance to deformation either lengthwise or sideways, and the electrostatic disturbance which they involve. There is no better example of the effect of new discoveries in giving new meaning to a theory while they leave the truth of the theory unaffected, and of the way in which modern research, instead of being content with evidence of one kind, as were the older organic chemists with that of chemical reaction, draws its material from every side and from every branch of chemistry and physics.

The position of structural theory is peculiar both in its extent and in its limitations. In predicting the number of isomeric forms that can exist, it is infallible; it may not be possible always to obtain all the forms, for the theory says nothing about stability, but wherever a new form can be obtained, there is a new formula ready for it. On the other hand, the theory gives very limited representation of the properties of the linked atoms, and in particular of the reactivity. We write the link of carbon to chlorine in the same way (C—Cl) in chlorobenzene, where the chlorine can scarcely be removed by anything short of metallic sodium, and in acetyl chloride, which is hydrolysed almost explosively by water. In fact, the properties of a link are not determined solely by the atoms which form it (which are all that the structural theory takes into account), but are modified by all other atoms in the molecule.

In the light of modern knowledge, continued Professor Sidgwick, it should be possible to explain both the successes and the failures of the structural theory. We may take the successes first—the power which the theory has of predicting the number of separable isomeric forms of a molecule which can exist. If a compound is to be separable, it must not change at once into something else; we may fairly say that unless a molecule lives in one form for more than a second, before it changes over into another isomeric form, the two will be regarded as one substance. Now we know that if a change is slow, that is because the molecules need to acquire extra energy before they react. Recent work, especially that of Eyring and Polanyi, has shown that this extra energy—the heat of activation—is mainly devoted to stretching the

links so as to bring the atoms into the positions required for the production of the new molecule. The consequent rearrangement of the electronic orbits takes place relatively easily. Thus the change from one form to another will occur the more easily, the less the differences of position of the atoms in the two molecules; if this difference is very small, the change will occur at once, and we shall not be able to separate the less stable form at all. Thus the number of separable isomeric forms is the number of different arrangements in space of the atoms that are possible.

Success of the Structural Theory

It would thus seem that the structural theory owes its success to the fact that it prescribes all the possible arrangements in space that a given group of atoms can assume. This conclusion is entirely supported by the physical evidence. We know that the distance between two linked atoms is a very constant property; it is very little affected by the other atoms in the molecule; it is only reduced about 10 per cent. by the conversion of a single into a double or of a double into a triple link. Recent work has indeed shown that these distances are capable of certain highly significant modifications, but these also are all small—of the order of 10 per cent. Also the inter-valency angles are fairly constant: that between two single links is 110°, and that between a single and a double link 125°. Both the experimental and the theoretical evidence show that the establishment of a single covalent link between two atoms is the fundamental process in molecular structure, and that its dimensions are little affected by variations in the rest of the molecule.

Both the theoretical and the experimental evidence leads to the conclusion that in the formation of amolecule we have to distinguish two factors—first, the simple linkage between the atoms, and secondly, a further influence on these links of the other atoms in the molecule which are not directly attached. The first of these determines the positions of the atoms in space, and therefore the individuality of the compound; it is this factor which is expressed by the ordinary structural theory, and that is why that theory is able to determine the number of possible—that is, isolable—forms The second factor has a large effect on the reactivity of the molecule; it is not regarded by the structural theory, which therefore cannot make any statement about the reactivity, except in the organic sense of showing in what order the atoms are linked, which depends on the first factor and not the second.

Equations of Wave Mechanics

Indeed, it is not to be expected that any simple theory should express so complicated a phenomenon as the interaction of all the nuclei and all the electrons of a molecule with one another, which even in benzene is a 54 or at least a 42-body problem. The full theoretical solution must wait until the application of the equations of wave mechanics has been made much easier than it now is. At the same time we may hope to arrive at new principles of structure which will be applicable even where a complete calculation cannot be carried out. One such principle has already been discovered, and it constitutes the most important development of structural chemistry since the days of van't Hoff. This is the principle of resonance, due originally to Hund, but applied to organic chemistry mainly by Pauling and his school. The conclusions of this theory can only be reached by wave-mechanics, but they can fortunately be expressed in very simple terms. The chemical evidence shows, as has long been known, that when two different structural formulæ can pass into one another by a mere rearrangement of single and multiple links, without either separating two linked atoms, or joining two that were separate, then if we synthesise the two we get the same substance, which has the reaction of both forms; the classical example is the two Kekulé structures for benzene. This is explained by the relation between reaction velocity and spatial position; the two structures will have their atoms in nearly the same positions, and so the rate of change will be very great. But the resonance theory takes this much further. The equations of wave-mechanics show that if a molecule can be represented, on the ordinary structural thory, by two different structures, then under certain conditions its actual state is not either one or the other, nor a mixture of the two in chemical (tautomeric) equilibrium, but is a structure intermediate between the two, which cannot be represented by the ordinary symbols, and which has the properties of both. This phenomenon is known as resonance; it is a bad name, because it suggests that the molecule is oscillating between the two structures, which is not the fact; it would be much better to give it some such name as mesomerism, if that is not otherwise occupied, but as long as the physicists use the term resonance we must follow their example.

The conditions which must be satisfied for resonance to be possible, are two: (1) the positions of the atoms in the two structures must be nearly the same; the actual position of the hybrid will be somewhere between them, and so involve a certain amount of strain with respect to either, but this must not be large; (2) the stabilities of the two must not differ greatly, or, as we may say, neither structure must be too improbable. The state of the hybrid is not necessarily halfway between the two structures, but it lies nearer to the more stable one. The occurrence of the resonance produces two important physical effects. First, the energy content of the molecule is smaller, or its stability greater, than that of either form; this is of fundamental importance, because it follows that resonance must always occur whenever it is possible.

Three Formulæ for Carbon Dioxide

The resonance energy may be very considerable, amounting sometimes to as much as the energy of a single link (up to 70,000 cals.). This affords one means of detecting the occurrence of resonance, since the heat of combustion of the hybrid must be smaller, or its heat of formation larger, than we should calculate for either of the two structures. The second effect, which again is important for detecting the resonance, is that the linked atoms come rather nearer together than in either of the separate forms, owing to the greater strength of the link.

Carbon dioxide can have three formulæ:—

	$O=C=O$	$O\leftarrow C=O$	$O^{\rightarrow}_{=}C\rightarrow O$	Observed.
Dist.	1.28 1.28	1.42 1.13	1.13 1.43	o.....o
	2.56	2.56	2.56	2.30 A.
Ht. of Formn.	348	ca. 350	ca. 350	380. k.cals.

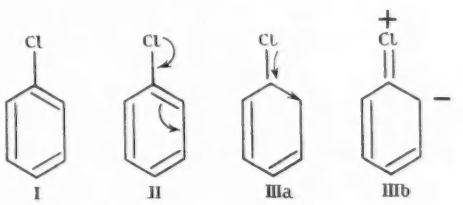
These structures satisfy the first condition because they are all linear, and the distances between the atoms do not differ greatly; the second condition because the heat of formation of the link of carbon to oxygen is very nearly proportional to its multiplicity, and the electrostatic disturbance produced by the co-ordination does not seem to have much effect on the energy. Resonance is therefore possible, and that it occurs is shown by two characteristic results: (1) the heat of formation of the carbonyl group in aldeydes and ketones is 174 k.cals, and so that of $O=C=O$ should be 348 k.cals, the observed value being 380, and excess of 32 k.cals; (2) the distance from oxygen to oxygen should be, in any of the three forms, 2.56 A., while it is found to be 2.30 A.

Many other examples could be quoted. The most obvious are those in which there are two atoms similar except for a difference of linkage and where the resonance causes this difference to vanish. The same thing must happen with the carboxyl ion $-C\langle^{O}_{O}$ It is also established by the crystallographic evidence for the NO_3' and CO_3'' ions. These can be shown to be plane structures, as the tetrahedral theory requires for the two formulæ $O=N\langle^{O}_{O}$ and $O=C\langle^{O}_{O}$, but the three oxygen atoms can be shown in both ions to be at the points of an equilateral triangle, with the nitrogen or carbon at the centre. Here again it is clear that the three oxygens exchange their functions and the double link is not localised on any particular one of them. Here, too, we find the characteristic

shortening of the link. The values are: for NO_3', N–O 1.36, N=O 1.22, mean 1.31, obs. 1.23; for CO_3'', C–O 1.43, C=O 1.28, mean 1.38, obs 1.23.

There are many important applications of this theory, for example, to the co-ordination of hydrogen, to triphenyl methyl, to the triphenylmethane dyes, to the meri-quinoid compound, to the inactivity of the C=O group in acids and esters. One application is of such far-reaching importance. The theories of reactivity put forward by organic chemists during the last 20 or 30 years find in the theory of resonance their physical justification. These theories agree in assuming a drift of electrons from their normal positions, not amounting to a complete transference, and ascribing the changes in reactivity to this. This electronic drift is exactly what the theory of resonance requires. To express the organic doctrines in terms of resonance we have only to imagine the electronic drift extended to the point where a new structural formula is reached. This gives us the second resonance structure, and the actual state of the molecule is somewhere between the two.

To account for ortho and para substitution in chlorobenzene it is assumed by the organic theorists that there is a drift of electrons from the chlorine atom towards the ring (formula II). If we suppose this drift to go to the extreme we get a new formula III (the two ways of writing it IIIa and IIIb mean the same thing) the further change transferring the negative charge to the para atom is omitted for brevity). The properties implied by formula II are exactly those of a resonance hybrid of the structures I and III. Evidence



of two different kinds has been obtained in support of this view. It has been shown by Sutton (" Proc. Roy. Soc.," 1931, *133*, 668) that the dipole moment of chlorobenzene is less than that of a chloroparaffin, and so indicates an electronic drift towards the ring. The difference is 0.59 D., which is about a tenth of what we should get by the complete transference of an electron from one atom to the next, so that the state of the hybrid must lie nearer to I, and II must be the less stable form, which is what any organic chemist would expect.

Visits in and around Bristol

Long Ashton Research Station

FOLLOWING the annual meeting of the Chemical Society at Bristol on Thursday and Friday, visits were paid by members to the University of Bristol Agricultural Research Station at Long Ashton, the works of the National Smelting Co., Ltd., at Avonmouth, and the chocolate factory of J. S. Fry and Sons, Ltd., at Somerdale.

Broadly speaking, the investigations in hand at Long Ashton fall into the following main divisions: Pomological Section (pomology, nutrition of fruit trees, fruit soil surveys, fruit quality, including in particular storage quality, and plant physiology); Plant Pathological Section (biology of diseases and pests of fruit trees and vegetables, methods of control of diseases and pests, insecticides and fungicides, and the technique of spraying); Fruit Products Section (cider fruit and its culture, cider making, by-products of the cider industry, fruit products in general, and methods of preservation of fruit and vegetables applicable to domestic conditions); Willow Section (the culture of basket willows and the cricket bat willow, pests and diseases of willows and their control, and the utilisation of willow rods and timber and their by-products).

Apple Growing and Cider Making

During the visit the fruit plantations, the pot culture station, the cider house and the laboratories of the Institute were visited. The part which chemistry is playing in the Long Ashton programme will be seen from the following lines of work in progress:—

(1) Laboratory technique for the examination of insecticidal and fungicidal properties, applied to: (a) the elucidation of the mode of action of the sulphur and copper fungicides; (b) the analytical evaluation of extracts of derris and lonchocarpus roots as insecticides; (c) the standardisation of organo-mercury seed disinfectants; and (d) the discovery of new insecticides and fungicides along chemotherapeutic lines.

(2) The physico-chemical factors which determine the degree of retention of sprays and dusts applied to crop plants: (a) the assessment of wetting, spreading and penetrating properties; (b) the utilisation of detergents, wetting-out agents and other surface-active products as spray spreaders.

The Long Ashton Station was largely responsible for the introduction and development of tar oil winter washes, and has played a major rôle in the development of the so-called " mixed " washes for spring and summer use. Success in spraying is greatly effected by the mode of application of the sprays, which calls for highly efficient equipment and skilled organisation of labour. Studies at Long Ashton have led to the development of a mobile system of spraying and to the use of spray guns. The investigations have resulted in the speeding-up of spraying operations and have effected great economies in spraying costs.

The chief investigations of a chemical nature in connection with cider and fruit products are concerned with the following: (a) Determination of sugar, acid and tannin contents in fresh apple juice, and the variations in each during fermentation and subsequent storage. (b) The isolation of the astringent principle in cider. (c) The rôle of pectin in cider-making processes; (i) its removal by natural processes during fermentation; (ii) removal of pectin by specific enzymes. (d) Effects of cider on metals, with a view to determining the suitability of metals for cider-making equipment and storage vessels. (e) The effect of centrifuging on the nitrogen content of fermenting ciders. Experiments have suggested that centrifuging effects on fermenting juices are possibly largely due to effects on nitrogenous constituents of the juices.

One special chemical problem has arisen in connection with the use of fruit syrups in combination with milk. The mixture is liable to curdle unless the pH is kept within strictly defined limits. Methods of buffering and removal of acidity are being studied.

Experiments have recently been commenced to discover whether cider which has started to acetify can be economically converted into cider vinegar. This product is the standard type of vinegar in use in the North American Continent, and excellent vinegars have been produced at Long Ashton on a small scale from ciders not suitable for bottling.

Chocolate Making at Somerdale

At their chocolate factory at Somerdale, J. S. Fry and Sons, Ltd., can boast of a commercial laboratory which is one of the finest in the country. It is divided roughly into analytical, bacteriological and entomological. Here the analysis of raw material, packing material and intermediate products, together

The Laboratory at the Chocolate Factory of J. S. Fry and Sons, Ltd., at Somerdale.

with finished goods, is made. On the other side, research is made into the prevention of the introduction of infestation, and the means of dealing with it. Also the ways and means of dealing with fermentation in confectionery centres, calling for the reproduction of shop and shop-window conditions.

In the course of a year, over 15,000 samples are examined. Experiments are also made before new lines are released, and the laboratory is responsible, too, for the development and improvement of existing lines.

After the laboratory the first department visited was that devoted to the making of cardboard boxes. One floor, the largest in this country, is an acre in extent. Here machines plus girls produce not only prosaic brown outers, but also those magnificent caskets which sell at two guineas apiece. From here the visitors were led through spacious corridors and towering buildings to the roasting department, where the cocoa bean begins its long journey before it becomes either cocoa or chocolate.

The first three processes in the making of either cocoa or chocolate are identical. They are roasting, winnowing and crushing. The last results in a thick brown liquid. Should this be required for cocoa 50 per cent. of the cocoa butter content is pressed out, which leaves a hard, solid cake. This is disintegrated, blended and ground until it is fine enough to pass through silk mesh of 13,500 holes per sq. in. Only then is it ready to be packed in the tins which also are made in this factory.

In the case of chocolate, this liquid is mixed with sugar (milk being added for milk chocolate), and the mixture then passes through a series of steel rollers, mixers and emulsifiers, the latter process taking 72 hours to complete. It is then ready for the moulding department, from which emerge bars, blocks and tablets which are snatched up immediately for the wrapping machines before skilful girls pack them into outers.

Zinc Smelting at Avonmouth

The raw material employed at the Avonmouth works of the National Smelting Co., Ltd., is a zinc concentrate received from mines in Australia, Newfoundland and elsewhere. It consists mainly of zinc sulphide, together with small amounts of iron sulphide, lead sulphide and gangue. The first stage in the process is the de-sulphurisation of the ore. This is effected in the roasting department. In past years mechanical furnaces have been used for this purpose, but modern practice has developed a sintering procedure whereby the ore is not only de-sulphurised, but is delivered in the form of a coke-like material which gives improved results in the subsequent distillation process. The sintering machine consists of an endless grate passing over a series of suction boxes, through which the SO_2 laden gases are drawn off to the acid plant.

The sinter from the roasting department is crushed and delivered to the distillation department. One of the processes operated in this department is the horizontal retort process. A horizontal furnace contains 384 retorts, each of which is manually charged each day. The charge consists of sinter and anthracite duff as a reducing material. Condensers are placed in position and luted with clay.

A corner in the Cider House at Long Ashton Research Station, filtering in progress.

Recent Progress in Large-Scale Oxygen Production

A Notable Reduction in Process Costs

PROGRESS in large-scale oxygen production in the last five years has resulted in reducing the cost by 60 per cent., said Dr. R. Linde in a lecture to the Vereins f. Bergbaulichen Interessen, at Essen, on November 8, 1935. Plants with a productive capacity of several thousand cubic metres of oxygen per hour are now in operation. The price of oxygen supplied in gas cylinders has been scarcely affected by the improved methods of production, but new ways of economically employing oxygen have been opened up, as in the production of industrial gases and the smelting of metals.

Rectification of Liquid Air

For the large-scale production of oxygen, practically only the rectification of liquid air comes in question, and this method is constantly being further developed. In the rectification, the air must have been cooled to the point at which it is mainly liquid, and the temperature required for this is about −190° C. The production of cold in the process consumes energy; a machine for producing artificial ice consumes about 100 calories per h.p.-hour under favourable conditions. In the separation of the constituents of air the aim is keep the cold performance as small as possible; this is accomplished by utilising the cold contained in the separated products, that is, the "latent" cold for liquefying, and the sensible cold for cooling the air to the liquefying temperature. If the separating plant is completely insulated against outside heat no appreciable cold production in the ordinary sense is required, and in well insulated plants the cold recovery from the separated products has been for a long time more than 98 per cent.

The cold loss to the outside is held within comparatively small limits, and in the larger separating plants does not amount to more than about 2 calories per cubic metre of air. This corresponds to an energy expenditure of 0.15-0.20 h.p.-hour per cubic metre of oxygen; that is, of the total energy consumed, only about 25 per cent. is thus utilised, the remaining 75 per cent. being used for compressing the air. On theoretical grounds, a certain amount of energy is expended in the separation of the liquid air constituents, because the two products must be brought up from their small partial pressures to atmospheric pressure. The consumption of the total energy for this purpose is about 20 per cent.

Separation of Oxygen and Nitrogen

The separation of the oxygen and nitrogen of liquid air rests on the fact that nitrogen has a boiling point of −196° C. and oxygen one of −183° C., but, as both are soluble in one another, a complete separation requires a rectifying treatment similar to that employed in the chemical industry for separating liquid mixtures. The heating and cooling of the rectifier, however, cannot be effected from the outside because this would result in a large loss of cold, requiring a corresponding amount of more energy. The usual practice, therefore, is to regulate the temperature of the rectification column by the condensation of air or the nitrogen which is derived from it.

The air is first passed through a heat exchanger in countercurrent to the separated products and is there cooled to the liquefying temperature. It then passes to the rectifier, in the column of which, under 4.5-5 atm. pressure, it is first separated into fractions, one of which contains about 40 per cent. oxygen, and the other practically pure nitrogen. A reflux condenser at the head of the column condenses the rising air vapours and about half the liquid formed falls back into the column, washing out oxygen from the ascending air and becoming enriched in oxygen to form a 40 per cent. oxygen product. This liquid, as well as the remaining part, is taken to an upper column of the rectifier where the constituents become separated into approximately pure oxygen and nitrogen. The heat of the upper column is derived from the condensation of the nitrogen, and this heat serves for the evaporation of the oxygen which flows out of the upper column. Thus, nitrogen at a pressure of about 4.6 atm. and oxygen at a pressure of about 1.4 atm. exchange their latent heats; the pressure of 4.6 atm. results in the temperature of the liquid nitrogen being higher than that of the oxygen at 1.4 atm. pressure.

To compensate for a certain pressure fall, the air from the compressor is received at 5 atm. pressure. For covering the energy expenditure for cold production, that is, the loss of cold the separating apparatus, the practice in the large plants is to compress from 15 to 30 per cent. of the gases to 100-200 atm. and then to expand them down to 1 atm.

A Modified Method of Production

A modification of the above process which considerably lowers the cost of oxygen production is now being used in many plants. A special difficulty in the method described was the forming of ice from the moisture in the air in the heat exchanger and the consequent interference with the air flow. Hence, a proposal by Frankl has been introduced, in which regenerators replace the countercurrent method, the principle of these regenerators being quite the same as in regenerators used in the gas industry, or for the preheating of the air blast in metal smelting. The air to be liquefied and separated is conducted from above downwards through the regenerator, which is termed the "heating" period, and alternately the cold separated products are passed through the regenerator in the opposite direction, which is known as the "cold" period, the passage in both cases occupying the same amount of time. The regenerators are arranged in pairs, of which one is for the oxygen and the other for the nitrogen.

In the first place the proposal to use regenerators was considered doubtful practice because, as generally known, the heat transmission efficiency is less in the usual regenerator than in the countercurrent heat exchangers. Frankl, however, was able to design a regenerator with great heat surface and rapid heat transmission; in one cubic metre of regenerator space more than 1,000 square metres of heating surface could be provided, and this with very small pressure loss in the air and its separated constituents. Moreover, the regenerators showed better heat transmission relations than by the low pressures used in the heat exchangers, and the cold transmission showed an efficiency of about 98 per cent.

Reduction in Pressure Fall

This high efficiency, coupled with the reduction in the pressure fall, results in a saving of about 25 per cent. in energy consumption as compared with the older method; on the one hand the pressure to be given the air is reduced by a few tenths of an atmosphere, and, on the other hand, the fraction of the air subjected to very high pressure is reduced to 4-5 per cent. Another advantage is that the difficulty due to ice formation is avoided, and the measures for removal of water vapour from the air, necessary in the older process to avoid interrupted operation, can be abandoned. The washing of the air with soda lye to remove the carbon dioxide is also unnecessary with regenerators; the carbon dioxide and also the ice formed during the "heating" period is sublimed in the "cold" period. Only the small part of the air which is highly compressed requires to be freed from carbon dioxide and water vapour because this must pass through a heat exchanger. This part of the air can be small because the greater part of the cold production is obtained through the expansion of the highly compressed air in an expansion machine, or through expansion of a part of the nitrogen out of the lower rectifying column in a turbine.

The respective costs by old and modified processes are given

in the following table in terms of pfennigs per cubic metre of oxygen :—

	Linde Process.	*Frankl-Linde Process.*
Energy at 2.5 pf. per h.p.-hr.	1.65	1.25
Service	0.15	0.10
Soda lye for CO_2 removal	0.10	0.005
Lubricants and Water	0.10	0.07
Amortisation	0.90	0.50
	2.90	1.925

In both cases it is assumed that 2,900 cubic metres of 85 per cent. oxygen, or 2,450 cubic metres of oxygen in an 85 per cent. mixture, were produced hourly. The advantages of a plant with regenerators is more apparent in large-scale working, as the larger plant units are relatively cheaper to install than the smaller units. While in the older plants capacities of 7,000 cubic metres of air per hour were employed, units with regenerators up to a capacity of 15,000 cubic metres of air per hour, corresponding to about 2,800 cubic metres of oxygen, are in operation, and one such has been in operation for more than two years.

Large Scale Production Costs

The Linde Eismachinen Gesellschaft has erected two plants, each for a production of 8,000 cubic metres of 98 per cent. oxygen hourly, in which the cost per cubic metre of oxygen produced is 1.530 pf. In large-scale operation, therefore, 98 per cent. oxygen can be produced round 1.5 pf. per cubic metre, if the energy required is available at 2 pf. per kW-hour. With still larger plants the amortisation would be less per cubic metre, but for the energy there would be no difference except from a smaller unit price. The possibility exists of obtaining cheap energy for the turbo-air-compressor which is the principal consumer of energy, from low-pressure steam turbines operated by the exhaust steam from high pressure units, and this may cost appreciably less than 2 pf. per kW-hour. As the cost of energy is the largest item in the total costs, a considerable reduction in the cost of that item would appreciably reduce the cost of obtaining oxygen.

When the oxygen is required for industrial gas production, a purity of about 63 per cent. suffices and this can be produced at a comparatively low cost. According to Polliter, gas producers operate more favourably with oxygen diluted to this extent, so far as the gas produced is suitable for its required purpose. In the manufacture of water gas to obtain hydrogen from it for ammonia synthesis the presence of nitrogen in the hydrogen up to about 25 per cent. by volume is advantageous; an objection is the presence of argon in the hydrogen-nitrogen mixture.

Utilisation of Cheapened Oxygen

By far the greater part of the cheaper oxygen produced has hitherto been employed in Winkler gas producers, which gasify small coal, and especially brown coal, in water gas producers. For the production of the hydrogen in this way for the I. G. Farbenindustrie hydrogenation processes, the fact that the gas so produced is somewhat high in carbon monoxide content is not of great importance, as this is cheaply converted into the dioxide which is removed by a pressure water wash. The energy consumed is chiefly for this pressure wash. If the gas is required for the hydrocarbon synthesis by the Fischer process, operated at atmospheric pressure, energy for compression for a water wash is all that is required.

Calculations have shown that the gasification in gas producers by the use of oxygen or air enriched in oxygen offers very considerable advantages. Good prospects are said to exist for the proposed Lurgi gasification process by the use of oxygen which permits the gas to be made from cheap low-grade coals. In this process the oxygen would require to be compressed, but the steam passes directly to the producer under pressure from the boiler.

New Technical Books

PUBLICATIONS OF THE KAISER WILHELM INSTITUTE FOR SILICATE RESEARCH, BERLIN-DAHLEM (Veröffentlichungen aus dem Kaiser Wilhelm Institut für Silikatforschung in Berlin-Dahlem). Vol. VII. Friedr. Vieweg and Sohn, Braunschweig.

Eitel and his collaborators are intellectual and independent research workers of high quality with enormous energy and an astonishingly wide range of vision. Their silicate-chemical researches are, however, not only interesting scientifically; their connections with the silicate industries—ceramics, glass, cement and enamel—run through a large amount of the work. The book is therefore valuable to the chemist, the physicist and the silicate specialist.

* * *

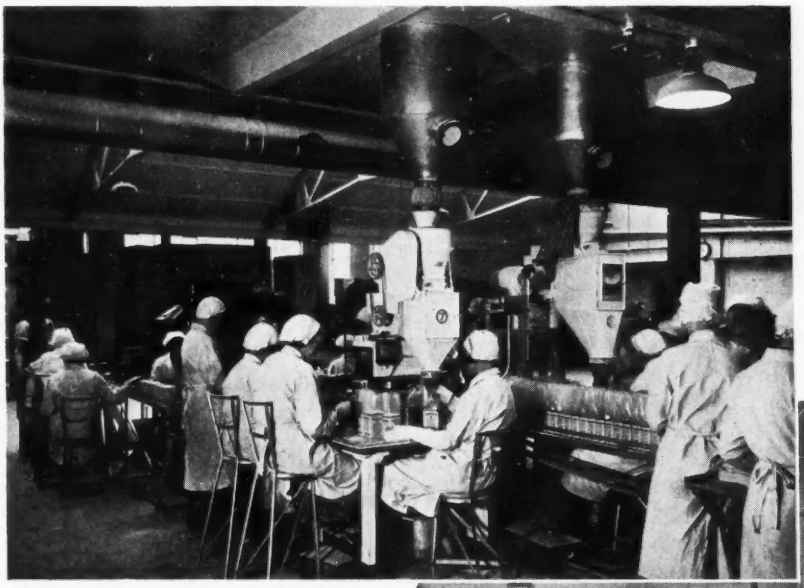
ABFALLSTOFFE DER ANORGANISH-CHEMISCHEN INDUSTRIE UND IHRE VERWERTUNG. By Emil J. Fischer. Pp. 164. Theodor Steinkopff, Dresden and Leippig. 10 marks.

This account of inorganic waste products and their utilisation includes brief but up-to-date descriptions of the more important inorganic processes themselves, for only by so doing could the significance of the waste products be brought home to the reader. In the introduction an attempt is made to draw a distinction between waste products and by-products By-products, it is pointed out, are more valuable and command a better market than waste products, means of utilising the latter in fact often being difficult to find. When the problem of profitable utilisation is solved, a waste product is promoted to the rank of by-product. Until this happy outcome is reached, the manufacturer will consequently make every effort to reduce the proportion of waste material in a given process. But the line of demarcation is not very clear for waste materials from many inorganic chemical processes are in enormous demand for such purposes as building and road-making, rubber products and plastic masses, polishes and cleansing preparations. Other types of waste, on the other hand, must be subjected to further refinement if their accumulation is not to disfigure the industrial landscape or prove fatal to river life. Taking the waste out of waste products thus benefits the community in a multitude of directions. Perusal of the present volume will undoubtedly prove of service to works' chemists and managers throughout the chemical industry, for in a surprisingly small space the author has managed to deal with almost every major and minor inorganic industry and its waste problems. A fittingly large space is apportioned to the acid and alkali industries, whilst the following section headings picked out at random bear witness to the wide net cast by the author: Mineral pigments, fertilisers, carbides, aluminium salts, potassium salts, silicates, metallurgical products. A promised companion volume on the organic chemical industries will be eagerly awaited.

* * *

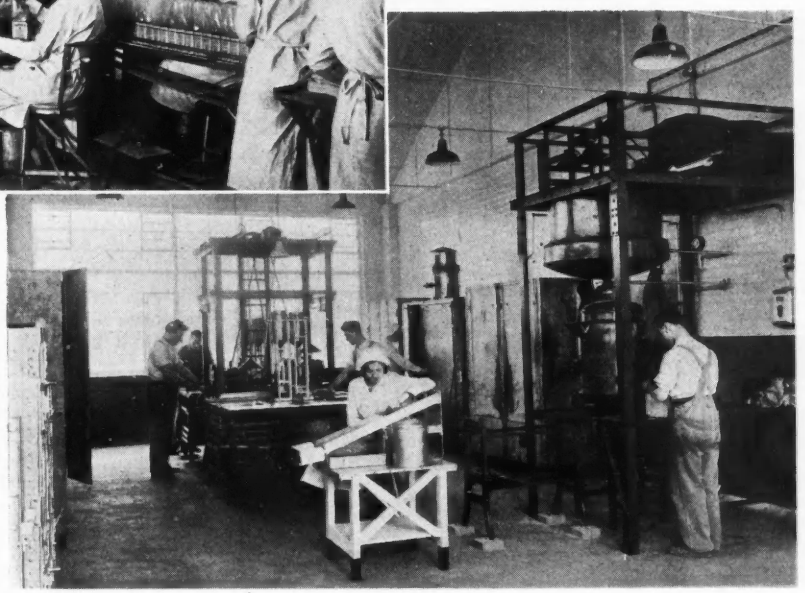
THE ACTION OF HYDROCHLORIC ACID ON TILED BUILDINGS (Die Einwirkung von Salzsäure auf Ziegelfassaden). By Professor E. Suenson. Danmarks Naturvidenskabelige Samfund, Copenhagen. Kr. 5.

Professor E. Suenson, of Copenhagen, had the task of determining the causes which led to a building in yellow bricks peeling shortly after completion. Suenson carried out this investigation in the laboratory for building technique at the Technical University in Copenhagen. His systematic work is exemplary, and entirely clears up the cause of failure. Conclusions can be drawn from it so that those and similar faults can be avoided in future. This small book, therefore, possesses considerable value for all interested in building.



Left: **Automatic weighing machines and gravity fillers are employed in the milk food packing department.**

Below: **The making of soft gelatine capsules is carried out with the aid of the press which is seen in the background. After cleansing, the finished capsules are graded to uniform size.**



The New Factory of Glaxo Laboratories, Ltd.

GLAXO Laboratories, Ltd., have recently built and equipped one of the largest pharmaceutical factories in England. Great changes have taken place in the activities of this firm within the last ten years. From 1924, when Ostelin vitamin D was introduced, the manufacture and standardisation of vitamin concentrates had to be accommodated; then came an increasing number of pharmaceutical products, and also vaccines. During this period the research and other laboratories of the organisation expanded so rapidly that the possibilities of ordered growth under existing conditions were progressively exhausted, and essential developments were frustrated by lack of space. Every extension served only to strengthen the conviction that sooner or later a specially designed group of buildings would have to be erected in their place. The new premises, constructed on a 15-acre site at Greenford, Middlesex, represent the fulfilment of this view.

The main building, which faces the Greenford Road, houses the offices, factory, and general laboratories, and is connected by a footbridge at first-floor level with an annexe for the bacteriological laboratory and physiological department. Situated behind this main building is the boiler house, and three separate buildings for manufacture and research on vitamin A and wheat-germ oil, "Farex," and calciferol and fine chemicals respectively.

The main stream of incoming goods enters the factory at the rear of the main building, where an elevated roadway leads from the Greenford Road. The heavy raw materials, brought by the Grand Union Canal, travel *via* a conveyor belt to enter the bulk storeroom. Pharmaceutical packing material is received at the right end of the building. Thus there are three streams of incoming goods, and, as the factory is planned for the "flow" system, these raw materials, after being processed—or generally have acquired greater utility—converge at the dispatch bay, which is between the main factory and the main office building on the ground floor.

One of the outstanding features of this new factory is its size; closer inspection reveals the functional unity that has been attained in the co-ordination of its separate parts. The buildings are planned from within to meet all the activities concerned in research upon and manufacture of pharmaceutical, bacteriological, vitamin, and milk food products. Everything is contrived for promoting an uninterrupted movement of raw material into the buildings and the finished packed products out of them. Efficiency, scientific control and the elimination of wasteful processes are facilitated by the mechanical structure of the laboratories. Furthermore, all the departments are so planned that separately or together they can be modified or extended for every purpose that they may be called upon to fulfil in the future.

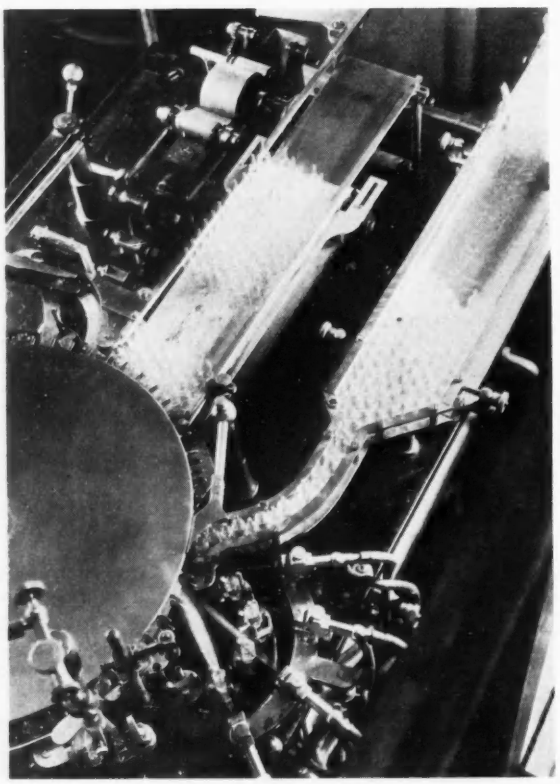
The general laboratory is placed midway between factory and office; there are also optical laboratories, and a laboratory (with photographic dark room) for the spectro-photometer used in vitamin A estimation. Illustrative of the "flow" system of production, milk powder for milk food manufacture is blended on the first floor, and goes through sifting apparatus straight into the gravity filling machines on the floor below. These are arranged in pairs, and the direction of "flow" is now across the room, empty containers at one wall finishing up filled, sealed, and boxed at the opposite wall, ready for the dispatch bay.

The first floor, which has ample space for future pharma-

ceutical manufacture, also contains the capsule room with its presses and drying ovens. Here soft gelatin capsules are prepared, and, after cleansing in a centrifugal washer, are carefully examined and graded to a uniform size. The ampoule department contains machinery, unique in this country, for labelling, filling, and sealing ampoules. Sterilised ampoules are fed into the machine from original containers, and in turn they are labelled, dried, filled and sealed at the rate of 1,000 per hour.

The first department to be in active production at Greenford was the bacteriological laboratory, the vaccine section of which is now engaged in the production of dissolved vaccines; its attendant sections are the media kitchen and vaccine packing room. In the physiological department on the second floor there is an animal experimental room, diet room, and animal stock room. The temperature in the animal stock room is controlled at 65°, and special top ventilation is provided.

In the emulsions department primary mixing is done by high-speed mixers on a mezzanine floor, and the emulsions



This ampoule filling and sealing machine deals with 1000 ampoules per hour.

are finally homogenised. Here two steam-heated pasteurisers and a centrifugal separator are also installed. The Glaxo Laboratories prepare a number of emulsified products, nearly all of which necessitate the manufacture of emulsions of the thin, milky type. It is well known that emulsions containing from 5 to 30 per cent. of oil require very careful formulation and processing if they are to remain stable, and it is vital that the emulsifying apparatus used should produce the finest degree of dispersion. The Impulsor emulsifier, which has been used by this company for several years, meets this need most satisfactorily. In addition to the large models which have a capacity of 100 gal. per hour, small Impulsor models with an output of 10 gal. per hour are also employed at Greenford. The Impulsor emulsifier has certain special features and its introduction has frequently led to the solution of emulsification problems.

For the convenience of the staff, a modern canteen is open to provide lunches. Space is available for social activities, and playing fields adjoining the buildings are to be laid out. Provision has already been made for dressing-rooms and shower baths, which can be used after the office, laboratory and factory buildings are closed.

The new home of Glaxo Laboratories, Ltd., is quickly reached from London via the Harrow and Bridgewater Roads, and by train it is not more than thirty minutes from Piccadilly Circus (Piccadilly tube), Marylebone (L.N.E.R.), or Paddington (G.W.R.). The three corresponding stations serving the Greenford district are within easy walk of the Laboratories, and buses (18c route) pass every ten minutes. Any reader of THE CHEMICAL AGE who may wish to visit the premises at Greenford and inspect the technical departments are assured of a most cordial welcome.

Personal Notes

DR. E. R. WEIDLEIN is the president-elect of the American Chemical Society.

MR. C. H. PICKLES has been appointed to the new factory of Courtaulds, Ltd., at Greenfield, Flintshire.

MR. J. M. COULSON, who has recently had the degree of Ph.D. of London University conferred upon him, has joined the staff of the Royal Arsenal.

MR. G. O. THACKER has taken up an appointment as chemical engineer with the British Launderers' Research Association.

MR. PHILIP I. WHITEHOUSE, of Beeches Lane, West Bromwich, has died at the age of 62. Mr. Whitehouse was an analytical chemist and more than 20 years ago he founded the business of Waste Products, Ltd., and Lewington, Ltd., industrial chemists, both of Bromford Lane, West Bromwich.

MR. F. PHILLIPS, who was successively secretary, commercial manager, general manager, and joint managing director of the Park Gate Iron and Steel Co., Rotherham, has died, aged 77, at his home at Wetherby, where he had lived in retirement for several years.

DR. L. H. LAMPITT, chief chemist of J. Lyons and Co., Ltd., has been nominated as hon. treasurer of the Society of Chemical Industry in succession to Dr. Colegate, and MR. J. DAVIDSON PRATT, general manager and secretary of the Association of British Chemical Manufacturers, has been nominated as hon. foreign secretary.

MR. THOMAS FIRTH, who was one of the directors of Thomas Firth and Sons, steelmakers, Sheffield, on the formation of the limited company, has died at his residence at Torquay, at the age of 85. He had lived at Torquay in retirement many years. Mr. Firth was a grandson of Thomas Firth, who founded in 1842 the company which is now merged with John Brown and Co.

MR. J. J. HURST has retired from the accountancy department of I.C.I. (Alkali), Ltd. He joined the staff of Brunner, Mond and Co., Ltd., nearly 49 years ago and has served in almost every section of the accountancy department. On his retirement he was presented by Mr. D. Marsh, delegate director, with a silver salver subscribed for not only by his colleagues in the department, but by more than 100 friends from other departments.

LORD AMULREE, who is to give an address on "Aviation" at the annual dinner of the Chemical Engineering Group on April 24, was Secretary of State for Air in 1930-31 and is able to speak with authority on this subject. He was also president of the Industrial Court from 1919 to 1926 and has been chairman of many important commissions, including the Royal Commission on Licensing and the Royal Commission on Newfoundland. He was chairman of the British Government Industrial Delegation to Canada and the United States, and he is the author of many legal works.

British Chemical Plant Exhibition

List of Exhibitors

WITH the exception of one small stand, the whole of the space at the British chemical plant exhibition has now been taken. The exhibition is being held at the Central Hall, Westminster, at the same time and in the same building as the International Chemical Engineering Congress of the World Power Conference, from June 22 to 27, and will provide outstanding evidence of the capabilities and advances by British chemical plant manufacturers.

An exhibit which is being organised by the Department of Scientific and Industrial Research to show the benefits of scientific research in industry with special reference to chemical engineering will illustrate activities covering a diversity of interests. The subjects dealt with will include coal and its by-products; iron and steel; high pressure work; heat transmission; the efficiency of pipe covering materials; corrosion-resisting alloys; water purification and softening; a new ether extractor and its applications; heat treatment of flour; the effect of paint on illumination; the use of rubber and refractories in chemical engineering. A number of items exhibited will probably be illustrated by a series of short films.

The exhibit is a co-operative one and a number of the research stations of the Department and industrial research associations are contributing on a co-operative basis and not as individual bodies. The following are the bodies concerned: The National Physical Laboratory, Fuel Research Station, Chemical Research Laboratory, Water Pollution Research Board, Research Association of British Paint, Colour and Varnish Manufacturers, Research Association of British Flour Millers, Research Association of British Rubber Manufacturers, British Non-Ferrous Metals Research Association, Industrial Research Council of the British Iron and Steel Federation, British Cast Iron Research Association, British Electrical and Allied Industries Research Association, and British Leather Manufacturers' Association.

The exhibition will be opened at 11 a.m. on Monday, June 22, in the great hall of the Central Hall. The opening will be followed by an official tour of the exhibition and an inaugural luncheon at the Hotel Victoria, Northumberland Avenue. Invitations are being extended to prominent delegates to the Congress from overseas, leading scientists, business men and representatives of Government Departments.

List of Exhibitors

The Aluminium Plant and Vessel Co., Ltd. (Stand No. A.7 and 9), Ashmore, Benson, Pease and Co., Ltd. (B.5), Audley Engineering Co., Ltd. (B.2), Henry Balfour and Co., Ltd. (B.23 and 28), Bennett Sons and Shears, Ltd. (A.12), British Gas Federation (B.4 and 6), The British Oxygen Co., Ltd. (B.20), Thomas Broadbent and Sons, Ltd. (A.15), Brown Bayleys Steel Works, Ltd. (B.30), Cannon Iron Foundries, Ltd. (A.10), THE CHEMICAL AGE (B.29), T. and C. Clark and Co., Ltd. (A.3), Dorr-Oliver Co., Ltd. (B.21 and 24), Doulton and Co., Ltd. (B.12), Enamelled Metal Products Corporation (1933), Ltd. (B.23 and 28), Firth Vickers Stainless Steels, Ltd. (A.6), Grant and West, Ltd. (A.5), Hadfields, Ltd. (B.3), Hathernware, Ltd. (A.11), Leonard Hill, Ltd. (A.4), The Hydronyl Syndicate, Ltd. (A.13), "The Industrial Chemist" (A.18), International Combustion, Ltd. (B.22), The International Electrolytic Plant Co. (B.19), S. H. Johnson and Co., Ltd. (B.8), George Kent, Ltd. (A.17), Kestner Evaporator and Engineering Co., Ltd. (A.1), H. K. Lewis and Co., Ltd. (B.14), Thos. Locker and Co., Ltd. (B.13), Manesty Machines, Ltd. (A.14), Manlove Alliott and Co., Ltd. (B.18), R. Marsh and Co. (B.16), The Mond Nickel Co., Ltd. (B.17), Negretti and Zambra (B.15), The Pascall Engineering Co., Ltd. (B.31), Premier Colloid Mills, Ltd. (A.19), Saunders Valve Co., Ltd. (B.9), George Scott and Son (London), Ltd. (B.23 and 28), Siebe, Gorman and Co., Ltd. (B.25), George Skey and Co., Ltd. (B.11), Society of Chemical Industry (B.26), Stevens and Manning (A.16), The Tintometer, Ltd. (A.2), Tungstone Patent High Pressure Die Casting Co. (B.27), United Steel Companies, Ltd. (B.7), United Water Softeners, Ltd. (B.32), Watson, Laidlaw and Co., Ltd. (B.1).

The Corrosion of Iron and Steel

Ravages of the Sea and Air

SIR Robert A. Hadfield and Mr. S. A. Main discussed on April 7, before the Institution of Civil Engineers, some further important problems concerning the corrosion of iron and steel, a subject which had been studied for 19 years by the committee of the Institution on the "Deterioration of Structures Exposed to Sea-Action." They pointed out that now that the united efforts of metallurgists, engineers, chemists and scientific workers had been organised into a world-campaign against corrosion, it would be expected that their work would go far towards finding a solution of the problem.

In the original scheme of research, fourteen types of material covering irons rolled and forged, carbon steels, special steels and cast irons were included, and a further material representing chromium steel of low carbon content was added later. Whilst the specimens in the main series of tests were distributed to stations at Auckland, Columbo, Halifax (Nova Scotia) and Plymouth, the further series of tests now described were based on tests at Ipswich, the Thames Estuary, the North Sea and the Gulf of Paria in Trinidad, and also on exposure tests in an urban atmosphere at Birmingham, and on marine buoys under the control of Trinity House at Ramsgate representing open sea conditions, at Harwich where the rough weather conditions are not so severe, and in the sea-reach of the Thames Estuary where the water was rather less saline and might therefore be expected to be different in its corrosive effects.

The authors explained the utility of practical exposure tests, as it was possible to obtain many results of an authentic nature in this way which engineers might safely use for their guidance. Laboratory tests intended to simulate practical conditions of corrosion had undergone considerable improvement in recent years, particularly in careful attention to details, and it had become possible to say what would be the behaviour of any particular steel, both as regards the amount of wastage and the character of the corrosive attack, provided that the composition of the metal and the physical conditions were specified, but for the present and some time to come they cannot take the place of practical tests.

The carbon and special steels were produced for the Committee by Hadfields, Ltd., of Sheffield; altogether 1,350 specimens were prepared. The results obtained from testing of roofing sheetings were of interest to many users. The advantages of low-percentage copper steel were being appreciated to the extent that many thousands of tons were being supplied annually, and Dr. F. N. Speller had estimated that about 9

million tons had been produced in the world during the previous 20 years. It had, however, certain limitations and disappointment might result in some cases. Nickel steels and chromium steel were also discussed and, in connection with the use of the latter in river-water, the authors mentioned that the softer grade of chromium steel (rustless iron) had been successfully used for the staunching bars of the Sennar Dam on the Upper Nile. Its behaviour when totally immersed in sea-water was, however, anything but satisfactory.

Special mention was made of protective oxide films, not more than 1.6 millionths of an inch in thickness which provide an armour or first line of defence for the metal against corrosion, to be penetrated before the ordinary electro-chemical processes of corrosion can get to work. The role played by oxygen in corrosion processes, and the extent to which "differential aeration" is effective in emphasising the peculiarities in corrosion, were discussed, as well as the importance of the effect of deposited dust particles and of corrosion fatigue.

As regards general wastage, the authors stated that in most cases, taking into account all the twelve methods and locations of marine exposure, the removal of the rolling-mill scale previous to exposure had the effect of increasing the amount of the general corrosion. As regards pitting, however, its influence was almost entirely favourable, and as a general average the depth of the deepest pit produced was from 2.14 millimetres to 0.92 millimetres. The best and most reliable material, among those available at the present stage of development of alloy steels, appeared to be steel containing about 36 per cent. of nickel. For carbon steels with the scale on, those high in sulphur and phosphorus proved the least satisfactory. The addition of small percentages of copper was shown to be of some benefit. The addition of chromium appeared beneficial in the tests above high-water mark, but in half-tide and complete immersion tests it resulted in excessive pitting. On the other hand, the wastage of the cast irons was, under similar conditions, generally much less than that of the rolled irons and steels and the pitting that they experienced was negligible in a five-year test. The true assessment of relative merits, however, would depend to some extent upon the form in which the materials were to be used.

The choice of cast iron in preference to rolled iron or steel in portions of marine structures was naturally determined to a large extent by its greater suitability, from a purely constructional point of view, for particular members. The results obtained in this research might encourage a preference for cast iron on the grounds of its lesser corrodibility, and so far as aerial conditions were concerned this would seem to be justified. The internal corrosion which the cast irons suffered in contact with the sea, and even under aerial conditions in a hot climate like Colombo, rather tended, however, to establish the preference in favour of rolled irons or steels.

The Chemical Age Lawn Tennis Tournament

Closing Date for Entries

THE last day for receiving entries for the sixth annual CHEMICAL AGE Lawn Tennis Tournament, full particulars of which were published last week, is Monday, May 11, and intending competitors are urged to apply without delay for the necessary entry forms, to The Editor, THE CHEMICAL AGE, Bouverie House, Fleet, Street, E.C.4. The tournament comprises men's singles and doubles, open to members of the chemical industry throughout Great Britain, either as principals or members of staffs, and this year, for the first time, it is possible for partners in the doubles to be members of separate firms, provided both are members of the chemical industry. THE CHEMICAL AGE silver challenge cups will be awarded to the winners, while smaller trophies will be presented outright to all the winners and runners-up.

The rules of the tournament are reprinted below, and copies of the full details may be obtained on application. Although the closing date is three weeks ahead, it will facilitate the arrangements for the tournament if forms are sent in as soon as possible.

Rules

1. Every competitor must be a member of the chemical industry, either as a principal or a member of a staff. There is no entrance fee of any kind.
2. Players in the Doubles need not necessarily be members of the same or associated firms, provided all players are members of the chemical industry as defined in Rule 1.
3. The Challenge Cups shall be competed for annually on courts of any surface in accordance with the Rules of Lawn Tennis and the Regulations of the Lawn Tennis Association. The winners of the Cups shall make arrangements for their safe custody and insurance.
4. The competition shall be conducted on the knock-out principle, and the best of three advantage sets shall be played in all matches, except in the finals when either the best of three or the best of five sets shall be played at the discretion of the Editor of THE CHEMICAL AGE and the members of the tournament committee present at the finals.
5. **Entries shall be made not later than May 11, 1936, on forms which may be obtained on application, to :**

"Lawn Tennis Tournament,"
"The Chemical Age,"
Bouverie House,
Fleet Street, London, E.C.4.

6. The draw shall be made on the first convenient day following the close of entries. The dates on or within which the several rounds must be played will be published in THE CHEMICAL AGE.
7. The Editor of THE CHEMICAL AGE, acting with the tournament committee, shall have the right to scratch any players who fail to play off their matches by the stipulated dates, or who otherwise fail to conform with the rules and regulations governing this competition.
8. Except in the case of the finals, players drawn against each other must make their own arrangements for playing off their match on a court mutually agreed upon. In the event of disagreement, the first name drawn shall have the right to choose the ground.
9. The result of each match must be sent by the winners to the Editor of THE CHEMICAL AGE, signed by all players (winners and losers), immediately after the match, and must reach the office of THE CHEMICAL AGE not later than by the first post on the day following the final day for playing off the round.
10. If any player be not present at the agreed place or time of the match, opponents shall be entitled to a walk-over, after having allowed reasonable time (say, a maximum of one hour) for the other's appearance. If the players find it impossible to play off their match on the day originally chosen, they must play it on any other day, to which both sides agree, within the stipulated period.
11. Any dispute arising between players, or otherwise, shall be referred to the arbitration of the Editor of THE CHEMICAL AGE, acting with the tournament committee, whose decision shall be final.
12. While competitors will decide as to hard or grass courts for the preliminary rounds, it must be understood that the Finals will be played on courts selected by the Editor of THE CHEMICAL AGE, acting with the tournament committee.

THE prospects of future hydro-electric developments have been recently discussed in relation to the encouragement of chemical industries in a memorandum submitted to the Government of Madras. The Papanasam project is to be undertaken to assist in the establishment of a pulp and paper factory in the Tinnevelly district. The Bezwada thermal station would bring into existence a cement factory, a number of sugar factories, and margarine and ghee factories. The Mettur hydro-electric scheme would provide sufficient opportunities for the starting of industries for the manufacture of straw-board, oil presses, chlorine, hydrogen, caustic soda, fertilisers and alkalis. Pykara power would be extended to Calicut, where cynamide can be manufactured.

The Detection and Control of Oxidation in Fats

Methods of Antioxidant Action

CHEMISTS investigate oxidation of fats and oils from two independent viewpoints. For several technical uses—that is, manufacture of paints, linoleum, etc.—the oxidation is usually induced to produce desirable qualities. Conversely, for food fats the effects produced are very undesirable, and the edible fat producers are making strides toward stabilising their products against oxidation, which in this case results in deterioration. The palatability of fats is adversely affected by oxidation. The vitamins associated with the fats or those contained in the food with which the fat is incorporated may be destroyed by the peroxides of the fat or by catalytic action with atmospheric oxygen produced by the rancid products in the fat.

The Characteristics of Rancidity

The term "rancid," according to a paper which R. C. Newton read before the American Chemical Society at its April meeting, is applied to a deteriorated fat. This term characterises flavour and odour produced in the fat and may be due to hydrolysis of short chain fat acids or the oxidation of long chain unsaturated fat acids that results in the production of volatile aldehydes, ketones, or other physiologically active substances. According to some of the latest reports, oxidation to produce rancidification takes place also with wholly saturated fat acid, but the liability of these to oxidation as compared to the unsaturated components of the fat is so small that it is relatively unimportant to the food chemist.

The chemistry of formation of peroxide and the ultimate destruction of the molecule with formation of undesirable constituents is still a matter of conjecture and is explained most simply by the addition of molecular oxygen at the unsaturated linkage with subsequent formation of a highly reactive peroxide. Since this method has shown some failures in explaining the oxidation of several pure organic compounds, other investigators have proposed a theory in which hydrogen atoms rather than molecular oxygen plays an important role. Electronic conceptions of the phenomenon have also been proposed. However, for structional visualisation of the various reactions that take place in the combination of unsaturated fats with oxygen and the breaking of the carbon chain, the peroxide theory seems to offer the best explanation of auto-oxidation of fats and oils.

Tests for Oxidation Resistance

Since rancidity is a characteristic described on the basis of flavour and odour and may be the effect of numerous compounds, it is difficult to correlate the amount of deterioration with chemical test. However, several tests are in use and many have been proposed. These tests deal with detecting any of the following: short chain acids, ketones, peroxides, aldehydes, volatile reducing compounds, or epihydrin aldehyde.

For practical purposes a test evaluating the resistance of a fat to oxidation is of prime importance because it gives an indication of the keeping quality of the product. The procedure for this deal with measuring the time necessary to produce rancidity under various standard methods of acceleration. The criterin for rancidity may be any of the above test methods, but preferably, in the newer communications, it is suggested that the organoleptic method should be used because the rate of formation of peroxide as compared to the formation of the degradation products for different fats is not the same.

Several factors influence the speed at which fats oxidise. The more unsaturated acids are most susceptible. Certain wave lengths of light, presence of oxygen, and some metals catalyse the reaction. Protection against the above and presence of natural inhibitors or addition of antioxidants reduces the speed of oxidation. There are several postulations as to the method of antioxidant action: (1) The antioxidant may be considered as an acceptor for the oxygen, and it must be oxidised first. (2) There may be union (chemical or adsorption) or blocking of the oxidisable group by the antioxidants. (3) It may absorb materials which promote oxidation. (4) It may be considered as a negative catalyst which poisons the positive catalyst. (5) It may depend on formation of difficulty oxidisable product or prevent formation of easily oxidisable intermediate product. None of these adequately explains these phenomena because the chemistry is not well known.

South African Chemical Notes

Cyanide Manufacture

CYANIDE, for use on the Witwatersrand gold mines, where the consumption is at least 9,000 tons a year, will be manufactured shortly in the Union on large scale. Three different plants are planned, including the pilot installation of the African Explosives and Industries at the Modderfontein dynamite factory, one by the famous American Cyanide Company, which recently sent their expert, Dr. Buch, on a mission to the Union, and the third by a South African syndicate, which is proposing to open its factories at Witbank. Large quantities of electric power will be required, and it is likely that the basic raw material will be ammonia prepared from the atmosphere, and sodium recovered from common salt. The annual consumption of cyanide in South Africa to-day is worth at least £500,000.

Proprietary Medicines

Legislation to prevent the publication of misleading advertisements in connection with patent and proprietary medicines is foreshadowed in the annual report for 1934-35 of the Department of Public Health. This report states that a committee has been investigating the question and has prepared a report, which will be made available to those interested. A large sum of money is spent annually by the public in South Africa and mainly by the poorer sections of the community, on the purchase of patent and proprietary medicines, many of which are quite worthless. Much of this results from the misleading and fraudulent advertisements. It is hoped that as a result of the labours of the committee it may be found possible for the Government to introduce legislation with the object of setting up effective machinery for bringing the whole matter under reasonable control.

Edible Vegetable Oils

A factory to produce edible oils and linseed and castor oil will shortly be operating in Cape Town. Hydrogenated fats will also be manufactured. The production of olives and other oil-bearing seeds or nuts in the Cape should be materially stimulated by the fact that a market for such goods will be available to growers at a satisfactory price. A director of the new company points out that the satisfactory production of edible oils and fat requires considerable skill, and for this reason technical experts of wide experience have been engaged and will be available to supervise the erection of the machinery and the subsequent production of oil. White labour is to be utilised as far as possible. There is considerable over-production of maize and wheat, and, as it is possible for wheat farmers to grow most of the cereals required by this new Cape Town company, their difficulties should be reduced. Similarly a good oil can be extracted from maize, and growers of both wheat and maize should therefore derive material assistance from the venture.

Continental Chemical Notes

Hungary

FOLLOWING AN AGREEMENT between the State Copper, Gold and Silver Mines at Kecske and the Metallo-Kemia Smelting Works of the Chemical Industry and Metal Trade Co., the last-named concern will erect a pyrites treating plant with the object of satisfying the entire home demands for sulphur.

Sweden

A TURNOVER IN THE HOME MARKET of 9.3 million crowns is announced by Stockholm's Superfosfat A.B., in its report for 1935. This compares with 7.6 million crowns in 1934. Export trade decreased slightly from the 1934 figure of 4.8 million crowns to 4.5 million crowns. Net profit is slightly higher at 890,000 crowns (857,000 crowns previously) and dividend is unchanged at 6 per cent. per share. Ammonium perchlorate manufacture has been abandoned at the Trollhättan works, where sodium chlorate is being produced in its place. The carbide plant in the same works has been kept in production despite the market difficulties.

Germany

THE FIRST FACTORY OF THE SOUTH GERMAN CELL WOOL CO., at Kehlheim, the construction costs of which are estimated at 9 million marks, is expected to commence production this autumn.

PROPERTIES OF THE CARBIDE FACTORY WYHLEN G.m.b.H., near Rheinfield (Upper Rhine), which is now in liquidation, have been purchased by the Deutsche Gold- und Silber-Scheideanstalt, who intend to use their current quota from the Ryburg-Schwörstadt Power Works for manufacture of carbide. The Scheideanstalt is entering into membership of the Carbide Association.

Russia

ACCORDING TO A BAKU REPORT a bromide factory is now in partial operation in that town.

FOR THE PAST TEN MONTHS, reports "Sa Industrialisazya," synthetic latex has been produced on a semi-works scale at the "B" Synthetic Rubber Factory in co-operation with the Research Institute of the Rubber Industry. In contrast with natural latex the new product (which is obtained by polymerisation of butadiene and its derivatives in aqueous emulsions) is claimed to be more stable. It is soluble in water, can be easily concentrated and can be used for impregnating fabrics and for making microporous ebonite substitute and soft imitation leather.

Belgium

PROSPECTS OF BELGIAN COAL HYDROGENATION were recently discussed by Professor Baudhiun, of Louvain University, who expressed misgivings over the high formation expenses with which the industry is saddled. Petroleum spirit is now sold at 50 centimetres per litre, whereas a minimum price of 1.30 francs appears to be inevitable for the synthetic product.

IN 1935 A PRIZE WAS OFFERED by the Royal Colonial Institute of Belgium for the best contribution to our knowledge of congo copal or the best proposal for its utilisation. The prize has now been awarded to M. L. Hellincks, of Louvain University, who discovered a new derivative, acetocopal, which is of vaue in paint manufacture. It is obtained by treating copal with acetic acid and acetic anhydride and takes the form of a soft transparent resin soluble in most industrial solvents with exception of ether, ligroin, carbon tetrachloride and alcohol. Unlike ordinary run copal, acetocopal is readily blended with cellulose, acetate and nitrocellulose. On the scientific side the prizewinner has proved that congo copal is essentially a mixture of certain dicarboxylic acids (congocopalic acids) which are transformed by the usual solubilising treatment (running) into monocarboxylic (congocopalolic) acids, one of the esterification products of which is acetocopal.

Jugoslavia

A FRENCH FINANCE GROUP is reported to be negotiating with the authorities at Slav Brod with a view to erecting a new factory for impregnating wood and for producing creosote oil and various medicinal products.

Finland

A CONTEMPLATED INCREASE IN THE CAPACITY of the Kotka sulphite cellulose factory of the Enso-Gutzeit O.Y., from 30,000 to 60,000 tons per annum, is announced. According to the "Chemische Industrie," a further expansion in Finnish cellulose production is projected by another (unspecified) concern which is planning to erect a new factory with an annual capacity of 100,000 tons in the south-western part of the country.

Italy

FOLLOWING HIGH PRESSURE HYDROGENATION RESEARCH at the Milan Polytechnic Institute, two large-scale plants have been erected at the Romano Bottazzi Works (Bergamo) and the Rumicana Works respectively. The former, with a daily capacity of 500 kg., is used for hydrogenation of fatty acids (palm oil, coconut oil) to lauryl-cetyl alcohol mixtures and operates at 250 atmospheres and 300° C. The Rumicana plant is primarily intended for production of tetra- and decahydronaphthalene, but can be switched over to hydrogenation of all liquid materials. A 250 litre electrically heated vertical autoclave constructed of a special steel is the central feature of this installation and can be operated up to 300 atmospheres and 500° C.

Far Eastern Chemical Notes

China

REVIEWING THE CHEMICAL INDUSTRY in the Province of Szetzchuan, "Chemische Industrie," April 4, states that two match factories are in operation at present: the Pei Ken match factory and the Tien Fu match factory. The former, founded in 1925 with a capital of $20,000, now employs about 400 girls and produces 600 cases (each containing 72,000 boxes) per annum, all of which are sold in the province. The latter, founded in 1932 with a capital of $10,000, produces only safety matches in an annual output of 500 chests valued at about $20,000.

Japan

A NEW PROCESS FOR VACUUM HYDROGENATION OF LIGNITE is reported to have been developed in the Tokio Physico-Chemical Institute. Including by-products, the output of liquid products amounts to 35 per cent. of the original volume of the coal. A Tokio report also deals with the projects of the Keyhin K.K., which proposes to erect a coking plant from which 10,000 tons of heavy oil could be produced from 100,000 tons of coal.

CONSIDERABLE ACTIVITY in the Japanese ammonium sulphate industry is reported by "Chemische Industrie," April 4. A company recently formed in Niigata, with a capital of 2 million yen, has brought its factory at Numatare to the production stage with an annual capacity of 18,000 tons. A factory with a capacity of 10,000 tons ammonium sulphate is projected in Fumushima by the Showa Rayon Co., who will utilise hydrogen obtained as a by-product in the manufacture of caustic soda. The Japanese Coal Tar Co. proposes to turn out 50,000 tons ammonium sulphate per annum as a by-product from its colour works at Kurosaki in the prefecture of Fukuoka. Finally, the Yahagi Kogyo K.K. is increasing its capital from 3 to 16.5 million yen with the object of enlarging its ammonium sulphate factory.

Weekly Prices of British Chemical Products

THE price of citric acid has been advanced from 11¾d. to 1s. per lb. With this exception the prices of chemical products remain unchanged from last week, and conditions generally have been quiet on account of the Easter holidays. Unless otherwise stated the prices below cover fair quantities net and naked at sellers' works.

LONDON.—Owing to the Easter holidays conditions have remained unchanged in the London chemical market, and prices are steady.

MANCHESTER.—Operations on the Manchester chemical market during the past week have been on quiet lines, buyers, generally, having shown little disposition to enter into fresh transactions of any consequence. More active conditions so far as new business is concerned may be expected next week when the influence of the Easter holidays will have worn off. Chemical-using works in Lancashire and West Yorkshire districts have not yet got fully into their stride again and the movement of chemicals against contracts as a result has been on a somewhat smaller aggregate scale. From the point of view of prices, however, market conditions remain satisfactory and there has been little giving way in any direction.

SCOTLAND.—There has been an improved demand for chemicals for home trade during the week, and rather more inquiry for export. Prices generally continue very steady at about previous figures with only slight changes to report.

General Chemicals

ACETONE.—LONDON: £62 to £65 per ton; SCOTLAND: £64 to £65 ex wharf, according to quantity.

ACID, ACETIC.—40% technical, £16 12s. 6d. per ton. LONDON: Tech., 80%, £30 5s. to £32 5s. per ton; pure 80%, £32 5s. to £34 5s.; tech., 40%, £16 12s. 6d. to £18 12s. 6d.; tech., 60%, £23 10s. to £25 10s. SCOTLAND: Glacial 98/100%, £48 to £52; pure 80%, £32 5s.; tech., 80%, £30 5s., d/d buyers' premises Great Britain. MANCHESTER: 80%, commercial, £30 5s.; tech. glacial, £48 to £50.

ACID, BORIC.—Commercial granulated, £27 per ton; crystal, £28; powdered, £29; extra finely powdered, £31; packed in 1-cwt. bags, carriage paid home to buyers' premises within the United Kingdom in 1-ton lots. B.P. cryst., £36; B.P. powder, £37. SCOTLAND: Crystals, £28; powdered, £29.

ACID, CHROMIC.—Flaked, 10d. per lb., less 2½%; ground, 10¼d. per lb., less 2½%, d/d U.K.

ACID, CITRIC.—1s. per lb. MANCHESTER: 1s. SCOTLAND: 11¾d.

ACID, CRESYLIC.—97/100%, 1s. 5d. to 1s. 6d. per gal.; 99/100%, refined, 1s. 9d. to 1s. 10d. per gal. LONDON: 98/100%, 1s. 5d. f.o.r.; dark, 1s.

ACID, FORMIC.—LONDON: £42 to £47 per ton.

ACID, HYDROCHLORIC.—Spot, 4s. to 6s. carboy d/d according to purity, strength and locality. SCOTLAND: Arsenical quality, 4s.; dearsenicated, 5s. ex works, full wagon loads.

ACID, LACTIC.—LANCASHIRE: Dark tech., 50% by vol., £24 10s. per ton; 50% by weight, £28 10s.; 80% by weight, £50; pale tech., 50% by vol., £28; 50% by weight, £33; 80% by weight, £55; edible, 50% by vol., £41. One-ton lots ex works, barrels free.

ACID, NITRIC.—80° Tw. spot, £18 to £25 per ton makers' works. SCOTLAND: 80°, £24 ex station full truck loads.

ACID, OXALIC.—LONDON: £47 17s. 6d. to £57 10s. per ton, according to packages and position. SCOTLAND: 98/100%, £48 to £50 ex store. MANCHESTER: £48 10s. to £54 ex store.

ACID, SULPHURIC.—SCOTLAND: 144° quality, £3 12s. 6d.; 168°, £7; dearsenicated, 20s. per ton extra.

ACID, TARTARIC.—1s. per lb. less 5%, carriage paid for lots of 5 cwt. and upwards. LONDON: 11½d., less 5%. SCOTLAND: 1s. 0¼d. less 5%. MANCHESTER: 1s. per lb.

ALUM.—SCOTLAND: Lump potash, £8 10s. per ton ex store.

ALUMINA SULPHATE.—LONDON: £7 10s. to £8 per ton. SCOTLAND: £7 to £8 ex store.

AMMONIA, ANHYDROUS.—Spot, 10d. per lb. d/d in cylinders. SCOTLAND: 10d. to 1s. containers extra and returnable.

AMMONIA, LIQUID.—SCOTLAND: 80°, 2½d. to 3d. per lb., d/d.

AMMONIUM BICHROMATE.—8d. per lb. d/d U.K.

AMMONIUM CARBONATE.—SCOTLAND: Lump, £30 per ton; powdered, £33, in 5-cwt. casks d/d buyers' premises U.K.

AMMONIUM CHLORIDE.—LONDON: Fine white crystals, £18 to £19. (See also Salammoniac.)

AMMONIUM CHLORIDE (MURIATE).—SCOTLAND: British dog tooth crystals, £32 to £35 per ton carriage paid according to quantity. (See also Salammoniac.)

AMMONIUM SULPHATE.—Neutral quality, 20.6% nitrogen, £7 per ton.

ANTIMONY OXIDE.—SCOTLAND: £61 to £65 per ton, c.i.f. U.K. ports.

ANTIMONY SULPHIDE.—Golden, 6½d. to 1s. 1d. per lb.; crimson, 1s. 5½d. to 1s. 7d. per lb., according to quality.

ARSENIC.—LONDON: £15 per ton c.i.f. main U.K. ports for imported material; Cornish nominal, £22 10s. f.o.r. mines. SCOTLAND: White powdered, £23 ex wharf. MANCHESTER: White powdered Cornish, £21 ex store.

ARSENIC SULPHIDE.—Yellow, 1s. 5d. to 1s. 7d. per lb.

BARIUM CHLORIDE.—LONDON: £10 10s. per ton. SCOTLAND: £10 10s. to £10 15s.

BARYTES.—£6 10s. to £8 per ton.

BISULPHITE OF LIME.—£6 10s. per ton f.o.r. London.

BLEACHING POWDER.—Spot, 35/37%, £7 19s. per ton d/d station in casks, special terms for contract. SCOTLAND: £9 5s.

BORAX, COMMERCIAL.—Granulated, £14 10s. per ton; crystal, £15 10s.; powdered, £16; finely powdered, £17; packed in 1-cwt. bags, carriage paid home to buyer's premises within the United Kingdom in 1-ton lots.

CADMIUM SULPHIDE.—5s. 2d. to 5s. 5d. per lb.

CALCIUM CHLORIDE.—Solid 70/75% spot, £5 5s. per ton d/d station in drums.

CARBON BISULPHIDE.—£31 to £33 per ton, drums extra.

CARBON BLACK.—3¾d. to 4¼d. per lb. LONDON: 4¼d. to 5d.

CARBON TETRACHLORIDE.—SCOTLAND: £41 to £43 per ton, drums extra.

CHROMIUM OXIDE.—10¾d. per lb., according to quantity d/d U.K.; green, 1s. 2d. per lb.

CHROMETAN.—Crystals, 2¾d. per lb.; liquor, £19 10s. per ton d/d

COPPERAS (GREEN).—SCOTLAND: £3 15s. per ton, f.o.r. or ex works.

CREAM OF TARTAR.—£3 19s. per cwt. less 2½%. LONDON: £3 17s. per cwt. SCOTLAND: £3 16s. 6d. net.

DINITROTOLUENE.—66/68° C., 9d. per lb.

DIPHENYLGUANIDINE.—2s. 2d. per lb.

FORMALDEHYDE.—LONDON: £24 10s. per ton. SCOTLAND: 40%, £25 to £28 ex store.

IODINE.—Resublimed B.P., 6s. 3d. to 8s. 4d. per lb.

LAMPBLACK.—£45 to £48 per ton.

LEAD ACETATE.—LONDON: White, £36 10s. per ton; brown, £1 per ton less. SCOTLAND: White crystals, £34 to £35; brown, £1 per ton less. MANCHESTER: White, £36; brown, £35.

LEAD NITRATE.—£32 10s. to £34 10s. per ton.

LEAD, RED.—SCOTLAND: £26 to £28 per ton less 2½%; d/d buyer's works.

LEAD, WHITE.—SCOTLAND: £39 per ton, carriage paid. LONDON: £41.

LITHOPONE.—30%, £16 5s. to £16 10s. per ton.

MAGNESITE.—SCOTLAND: Ground calcined, £9 per ton, ex store.

MAGNESIUM CHLORIDE.—SCOTLAND: £7 per ton.

MAGNESIUM SULPHATE.—Commercial, £5 per ton, ex wharf.

METHYLATED SPIRIT.—61 O.P. industrial, 1s. 5d. to 2s. per gal.; pyridinised industrial, 1s. 7d. to 2s. 2d.; mineralised, 2s. 6d. to 3s. Spirit 64 O.P. is 1d. more in all cases and the range of prices is according to quantities. SCOTLAND: Industrial 64 O.P., 1s. 9d. to 2s. 4d.

PHENOL.—6¾d. to 7¼d. per lb. to June 30, 1936.

POTASH, CAUSTIC.—LONDON: £42 per ton. MANCHESTER: £39.

POTASSIUM BICHROMATE.—Crystals and Granular, 5d. per lb. less 5%, d/d U.K. Ground, 5¼d. LONDON: 5d. per lb. less 5%, with discounts for contracts. SCOTLAND: 5d. d/d U.K. or c.i.f. Irish Ports. MANCHESTER: 5d.

POTASSIUM CHLORATE.—LONDON: £37 to £40 per ton. SCOTLAND: 99¼/100%, powder, £37. MANCHESTER: £39.

POTASSIUM CHROMATE.—6½d. per lb. d/d U.K.

POTASSIUM IODIDE.—B.P., 5s. 2d. per lb.

POTASSIUM NITRATE.—SCOTLAND: Refined granulated, £29 per ton c.i.f. U.K. ports. Spot, £30 per ton ex store.

POTASSIUM PERMANGANATE.—LONDON: 8¼d. per lb. SCOTLAND: B.P. crystals, 10d. to 10½d. MANCHESTER: B.P., 11¼d.

POTASSIUM PRUSSIATE.—LONDON: Yellow, 8¼d. to 8¾d. per lb. SCOTLAND: Yellow spot, 8¼d. ex store. MANCHESTER: Yellow, 8¼d.

SALAMMONIAC.—First lump spot, £41 17s. 6d. per ton d/d in barrels. SCOTLAND: Large crystals in casks, £36.

SODA ASH.—58% spot, £5 12s. 6d. per ton f.o.r. in bags.

SODA, CAUSTIC.—Solid, 76/77° spot, £13 17s. 6d. per ton d/d station. SCOTLAND: Powdered 98/99%, £17 10s. in drums, £18 5s. in casks, Solid 76/77°, £14 12s. 6d. in drums; 70/73%, £14 12s. 6d., carriage paid buyer's station, minimum 4-ton lots; contracts 10s. per ton less. MANCHESTER: £13 5s. to £14 contracts.

SODA CRYSTALS.—Spot, £5 to £5 5s. per ton d/d station or ex depot in 2-cwt. bags.

SODIUM ACETATE.—LONDON: £21 per ton. SCOTLAND: £20 15s.

SODIUM BICARBONATE.—Refined spot, £10 10s. per ton d/d station in bags. SCOTLAND: Refined recrystallised £10 15s. ex quay or station. MANCHESTER: £10 10s.

SODIUM BICHROMATE.—Crystals cake and powder 4d. per lb. net d/d U.K. discount 5%. Anhydrous, 5d. per lb. LONDON: 4d. per lb. less 5% for spot lots and 4d. per lb. with discounts for contract quantities. MANCHESTER: 4d. per lb. basis. SCOTLAND: 4d. delivered buyer's premises with concession for contracts.

SODIUM BISULPHITE POWDER.—60/62%. £20 per ton d/d 1 cwt. iron drums for home trade.

SODIUM CARBONATE, MONOHYDRATE.—£15 per ton d/d in minimum ton lots in 2 cwt. free bags. Soda crystals, SCOTLAND: £5 to £5 5s. per ton ex quay or station. Powdered or pea quality, 7s. 6d. per ton extra. Light Soda Ash, £7 ex quay, min. 4-ton lots with reductions for contracts.

SODIUM CHLORATE.—£30 per ton. SCOTLAND: 3¾d. per lb.

SODIUM CHROMATE.—4d. per lb. d/d U.K.

SODIUM HYPOSULPHITE.—SCOTLAND: Large crystals English manufacture, £9 5s. per ton ex stations, min. 4-ton lots. Pea crystals, £14 10s. ex station, 4-ton lots. MANCHESTER: Commercial, £10 5s.; photographic, £14 10s.

SODIUM METASILICATE.—£14 per ton, d/d U.K. in cwt. bags.

SODIUM IODIDE.—B.P., 6s. per lb.

SODIUM NITRITE.—LONDON: Spot, £18 5s. to £20 5s. per ton d/d station in drums.

SODIUM PERBORATE.—10%, 9½d. per lb. d/d in 1-cwt. drums. LONDON: 10d. per lb.

SODIUM PHOSPHATE.—£13 per ton.

SODIUM PRUSSIATE.—LONDON: 5d. to 5½d. per lb. SCOTLAND: 5d. to 5¾d. ex store. MANCHESTER: 5d. to 5½d.

SODIUM SILICATE.—140° Tw. Spot, £8 per ton. SCOTLAND: £8 10s.

SODIUM SULPHATE (GLAUBER SALTS).—£4 2s. 6d. per ton d/d SCOTLAND: English material, £3 15s.

SODIUM SULPHATE (SALT CAKE).—Unground spot, £3 12s. 6d. per ton d/d station in bulk. SCOTLAND: Ground quality, £3 5s. per ton d/d. MANCHESTER: £3 5s.

SODIUM SULPHIDE.—Solid 60/62% Spot, £10 15s. per ton d/d in drums; crystals 30/32%, £8 per ton d/d in casks. SCOTLAND: For home consumption, Solid 60/62%, £10 5s.; broken 60/62%, £11 5s.; crystals, 30/32%, £8 7s. 6d., d/d buyer's works on contract, min. 4-ton lots. Spot solid, 5s. per ton extra. Crystals, 2s. 6d. per ton extra. MANCHESTER: Concentrated solid, 60/62%, £11; commercial, £8 2s. 6d.

SODIUM SULPHITE.—Pea crystals, spot, £13 10s. per ton d/d station in kegs. Commercial spot, £8 15s. d/d station in bags.

SULPHUR.—£9 to £9 5s. per ton. SCOTLAND: £8 to £9.

SULPHATE OF COPPER.—MANCHESTER: £15 per ton f.o.b.

SULPHUR CHLORIDE.—5d. to 7d. per lb., according to quality.

SULPHUR PRECIP.—B.P., £55 to £60 per ton according to quantity. Commercial, £50 to £55.

VERMILION.—Pale or deep, 5s. 1d. per lb. in 1-cwt. lots.

ZINC CHLORIDE.—SCOTLAND: British material, 98%, £18 10s. per ton f.o.b. U.K. ports.

ZINC SULPHATE.—LONDON: £12 per ton. SCOTLAND: £10 10s.

ZINC SULPHIDE.—10d. to 11d. per lb.

Nitrogen Fertilisers

SULPHATE OF AMMONIA.—£7 5s. per ton for neutral quality basis 20.6% nitrogen delivered in 6-ton lots to farmer's nearest station.

CALCIUM CYANAMIDE.—£7 5s. per ton, delivered in 4-ton lots.

NITRO-CHALK.—£7 5s. per ton delivered in 6-ton lots to farmer's nearest station.

NITRATE OF SODA.—£7 12s. 6d. per ton delivered in 6-ton lots to farmer's nearest station.

CONCENTRATED COMPLETE FERTILISERS.—£10 10s. to £10 19s. per ton according to analysis, delivered in 6-ton lots to farmer's nearest station.

AMMONIUM PHOSPHATE (N.P.) FERTILISERS.—£10 5s. to £13 15s. per ton according to analysis, delivered in 6-ton lots to farmer's nearest station.

Coal Tar Products

ACID, CRESYLIC.—99/100%, 2s. 1d. to 3s. per gal., according to specification; pale 98%, 1s. 10d. to 2s.; dark, 1s. 6d. to 1s. 7d. LONDON: 98/100%, 1s. 4d.; dark, 95/97%, 1s. SCOTLAND: Pale, 99/100%, 1s. 3d. to 1s. 4d.; dark, 97/99%, 1s. to 1s 1d.; high boiling acid, 2s. 6d. to 3s.

ACID, CARBOLIC.—Crystals, 6¾d. to 7¼d. per lb.; crude, 60's, 2s. 3d. to 2s. 6d. per gal. MANCHESTER: Crystals, 7d. per lb.; crude, 2s. 2d. per gal. SCOTLAND: 60's, 2s. 6d. to 2s. 7d.

BENZOL.—At works, crude, 8½d. to 9d. per gal.; standard motor 1s. 2d. to 1s. 2½d.; 90%, 1s. 3d. to 1s. 3½d.; pure, 1s. 7d. to 1s. 7½d. LONDON: Motor, 1s 3½d. SCOTLAND: Motor, 1s. 6½d.

CREOSOTE.—B.S.I. Specification standard, 5½d. per gal. f.o.r. Home, 3¾d. d/d. LONDON: 4½d. f.o.r. North; 5d. London. MANCHESTER: 5d. SCOTLAND: Specification oils, 4d.; washed oil, 4½d. to 4¾d.; light, 4½d.; heavy, 4½d. to 4¾d.

NAPHTHA.—Solvent, 90/100%, 1s. 5½d. to 1s. 6½d. per gal.; 95/160%, 1s. 9d.; 90%, 1s. to 1s. 2d. LONDON: Solvent, 1s. 3½d. to 1s. 4d.; heavy, 11d. to 1s. 0½d. f.o.r. SCOTLAND: 90/160%, 1s. 3d. to 1s. 3½d.; 90/190%, 11d. to 1s. 2d.

NAPHTHALENE.—Crude, whizzed or hot pressed, £17 10s. per ton; purified crystals, £26 per ton in 2-cwt. bags. LONDON: Fire lighter quality, £3 to £3 10s.; 74/76 quality, £4 to £4 10s.; 76/78 quality, £5 10s. to £6. SCOTLAND: 40s. to 50s.; whizzed, 70s. to 75s.

PYRIDINE.—90/140%, 5s. 3d. to 7s. 6d. per gal.; 90/180, 2s. 3d.

TOLUOL.—90%, 2s. 3d. per gal.; pure, 2s. 7d.

XYLOL.—Commercial, 2s. 2d. per gal.; pure, 2s. 4d.

PITCH.—Medium, soft, 42s. 6d. to 43s. per ton, in bulk at makers' works. MANCHESTER: 37s. 6d. f.o.b., East Coast.

Wood Distillation Products

ACETATE OF LIME.—Brown, £7 15s. to £8 10s. per ton; grey, £10 10s. to £11. Liquor, brown, 30° Tw., 8d. per gal. MANCHESTER: Brown, £9 10s.; grey, £11.

CHARCOAL.—£5 to £10 per ton, according to grade and locality.

METHYL ACETONE.—40-50%, £46 to £50 per ton.

WOOD CREOSOTE.—Unrefined, 6d. to 1s. 3d. per gal.

WOOD NAPHTHA, MISCIBLE.—2s. 6d. to 3s. 3d. per gal.; solvent, 3s. to 4s. per gal.

WOOD TAR.—£2 to £2 10s. per ton.

Intermediates and Dyes

ACID, BENZOIC, 1914 B.P. (ex Toluol).—1s. 9½d. per lb.

ACID, GAMMA.—Spot, 4s. per lb. 100% d/d buyer's works.

ACID, H.—Spot, 2s. 4½d. per lb. 100% d/d buyer's works.

ACID NAPHTHIONIC.—1s. 8d. per lb.

ACID, NEVILLE AND WINTHER.—Spot, 3s. per lb. 100%.

ACID, SULPHANILIC.—Spot, 8d. per lb. 100%, d/d buyer's works.

ANILINE OIL.—Spot, 8d. per lb., drums extra, d/d buyer's works.

ANILINE SALTS.—Spot, 8d. per lb. d/d buyer's works, casks free.

BENZALDEHYDE.—Spot, 1s. 8d. per lb., packages extra.

BENZIDINE BASE.—Spot, 2s. 5d. per lb., 100% d/d buyer's works.

BENZIDINE HCL.—2s. 5d. per lb.

o-CRESOL 30/31° C.—6d. per lb. in 1-ton lots.

p-CRESOL 34-5° C.—1s. 6d. per lb. in ton lots.

m-CRESOL 98/100%.—1s. 7d. per lb. in ton lots.

DICHLORANILINE.—1s. 11½d. to 2s. 3d. per lb.

DIMETHYLANILINE.—Spot, 1s. 6d. per lb., package extra.

DINITROBENZENE.—8d. per lb.

DINITROTOLUENE.—48/50° C., 9d. per lb.; 66/68° C., 10½d.

DINITROCHLORBENZENE, SOLID.—£72 per ton.

DIPHENYLAMINE.—Spot, 2s. per lb., d/d buyer's works.

α-NAPHTHOL.—Spot, 2s. 4d. per lb., d/d buyer's works.

β-NAPHTHOL.—Spot, £78 15s. per ton, in paper bags.

α-NAPHTHYLAMINE.—Spot, 11½d. per ton., d/d buyer's works.

β-NAPHTHYLAMINE.—Spot, 2s. 9d. per lb., d/d buyer's works.

o-NITRANILINE.—3s. 11d. per lb.

m-NITRANILINE.—Spot, 2s. 7d. per lb., d/d buyer's works.

p-NITRANILINE.—Spot, 1s. 8d. per lb., d/d buyer's works.

NITROBENZENE.—Spot, 4½d. to 5d. per lb.; 5-cwt. lots, drums extra.

NITRONAPHTHALENE.—9d. per lb.; P.G., 1s. 0½d. per lb.

SODIUM NAPHTHIONATE.—Spot, 1s. 9d. per lb.

o-TOLUIDINE.—9½d. to 11d. per lb.

p-TOLUIDINE.—1s. 11d. per lb.

Latest Oil Prices

LONDON, April 15.—LINSEED OIL was steady. Spot £28 15s. per ton (small quantities); April, £26 2s. 6d.; May-Aug., £26 5s.; Sept.-Dec., £26 7s. 6d., naked. SOYA BEAN OIL was firm. Oriental (bulk), April shipment, £22 15s. per ton. RAPE OIL was steady. Crude extracted, £34 10s. per ton; technical refined, £36, naked, ex wharf. COTTON OIL was quiet. Egyptian crude, £25 per ton; refined common edible, £28 and deodorised £30, naked, ex mill (small lots £1 10s. extra). TURPENTINE was steady. American, spot, 39s. 9d. per cwt.

HULL—LINSEED OIL.—Spot quoted £26 15s. per ton; April, £26 5s. May-Aug., £26 7s. 6d.; Sept.-Dec., £26 10s. COTTON OIL.—Egyptian, crude, spot, £25; edible, refined, spot, £27 10s.; technical spot, £27 10s.; deodorised, £29 10s., naked. PALM KERNEL OIL.—Crude, f.m.q., spot, £23, naked. GROUNDNUT OIL.—Extracted, spot, £30 10s.; deodorised, £33 10s. RAPE OIL.—Extracted, spot, £33 10s., refined £35. SOYA OIL.—Extracted, spot, £27; deodorised, £30 per ton. COD OIL.—F.o.r. or f.a.s., 25s. per cwt., in barrels. CASTOR OIL.—Pharmaceutical, 42s. 6d. per cwt.; firsts, 37s. 6d.; seconds, 35s. 6d. TURPENTINE.—American, spot, 41s. 9d. per cwt.

Chemical Trade Inquiries

The following trade inquiries are abstracted from the "Board of Trade Journal." Names and addresses may be obtained from the Department of Overseas Trade (Development and Intelligence), 35 Old Queen Street, London, S.W.1 (quote reference number).

Holland.—A firm of importers and agents, with a staff of travelling salesmen, established at Amsterdam wish to obtain the representation, on a commission basis, of United Kingdom manufacturers of heavy chemicals; raw materials and semi-manufactured materials of all kinds. May also purchase for own account. (Ref. No. 252.)

Chemical and Allied Stocks and Shares

A MODERATE increase of business has been reported in the industrial section of the Stock Exchange, and while there was no general upward movement in share values, individual features of interest were not lacking. Shares of chemical and allied companies were steady, Imperial Chemical Industries ordinary continued to atract increased attention. On the basis of last year's 8 per cent. dividend they offer a yield of fully 4 per cent. The deferred shares were also more active on calculations current in the market that on the basis of the terms of the exchange into ordinary shares, the deferred are still slightly undervalued in relation to the ordinary. William Blythe 3s. ordinary shares have been steadier since publication of the full results. The possibility of a larger interim dividend continued to maintain a very firm tendency in Fison, Packard and Prentice, and British Cyanides were aided by the possibility of the resumption of the practice of paying an interim dividend. In any case the market is looking for the publication of a progress report by the directors before long and it is being assumed that the upward movement in the company's profits is being accelerated in the current year. Borax Consolidated deferred attracted increased attention. The yield offered by the shares is not large on the basis of last year's 5 per cent. dividend, but this has to be read in relation to the scope for further recovery in the company's profits, which in the past were at a high level, and also to the increasing demand for borax, reference to which was made at the last annual meeting. Distillers have been good on the belief that if there is a reduction in the spirits duty granted by the Budget there will be prospects of a larger dividend or perhaps a share bonus. Various of the company's subsidiaries are likely to issue their results before long. United Molasses were reported to be in larger demand on continued anticipations of a possible interim dividend and on confidence that the directors will issue a progress report in accordance with the course followed last year. Goodlass Wall and Lead Industries were again firm, awaiting the results and Imperial Smelting ordinary held up well. Triplex Safety Glass were again prominent, partly on the hope that the directors may resume the custom of paying an interim dividend and on the possibility of an eventual bonus, reference to which was made by the directors earlier in the year. It is being assumed in the market that in view of the increased output of leading motor car manufacturers, which are important users of safety glass, the company's profits are probably continuing to advance, Unilever were active and Salt Union very firm. There is continued talk in the market that a bonus is possible in the future from the latter company, but it is realised that this course is not likely to be followed unless the company's important interest in the Mersey Power Company is sold, and there has never been any official indication that the directors have this in mind. Pinchin Johnson and other paint shares were again good on the indications that the better activity in shipbuilding and the programme of modernisation and improvements to be carried out by the main line railways may lead to an important increase in the demand for paint. Reckitt and Son's ordinary shares have held their improvement to 115s. at the time of writing. United Glass Bottle Manufacturers ordinary were also good. Since the statement at the meeting that economies in working are likely to offset increased raw materials and wages costs, the belief has been current in the market that a favourable increase in dividend may be in prospect for the current year, although it has to be remembered that the directors invariably place a large proportion of the profits back into the business. Staveley Coal and Iron shares again attracted attention on anticipations of a larger dividend, but steel and iron shares generally were rather less active. Babcock and Wilcox ordinary shares have remained depressed on the disappointment of market hopes of a larger dividend. The cautious policy of the directors is no doubt explained by the fact that the company has important interests overseas. International Nickel were good, partly on the increase in copper prices in America which will benefit the company as it is an important producer of copper as well as nickel. Lever Brothers' preference have held their recent gains quite well. Oil shares were more active in view of the hopes attaching in the market to the forthcoming dividend announcements of the leading companies.

Name.	April 14.	April 7.
Anglo-Iranian Oil Co., Ltd. Ord	95/-	93/9
,, 8% Cum. Pref	37/9	37/9
,, 9% Cum. Pref.	38/3	38/3
Associated Dyers and Cleaners, Ltd. Ord.	**1/10½**	**1/10½**
,, 6½% Cum. Pref.	6/6¾	6/6¾
Associated Portland Cement Manufacturers, Ltd. Ord.	89/4½	88/9
,, 5½% Cum. Pref.	28/-	27/-
Benzol & By-Products, Ltd. 6% Cum. Part Pref.	6/3	6/3
Berger (Lewis) & Son, Ltd. Ord.	71/3	70/7½
Bleachers' Association, Ltd. Ord.	5/7½	5/7½
,, 5½% Cum. Pref.	10/-	10/7½
Boake, A., Roberts & Co., Ltd. 5% Pref. (Cum.)	**20/-**	**20/-**
Boots Pure Drug Co., Ltd. Ord. (5/-)	55/6	55/9
Borax Consolidated, Ltd. Pfd. Ord. (£)	112/6	112/6
,, Defd. Ord.	28/9	28/9
,, 5½% Cum. Pref. (£10)	£12	£12
,, 4½% Deb. (1st Mort.) Red. (£100)	£107/10/-	£107/10/-
,, 4½% 2nd Mort. Deb. Red. (£100)	£105/10/-	£105/10/-
Bradford Dyers' Association, Ltd. Ord.	8/1½	8/9
,, 5% Cum. Pref.	11/10½	11/10½
,, **4% 1st Mort. Perp. Deb. (£100)**	**£86/10/-**	**£86/10/-**
British Celanese, Ltd. 7% 1st Cum. Pfd.	25/9	25/3
,, 7½% Part. 2nd Cum. Pref.	21/6	21/-
British Cotton & Wool Dyers' Association Ltd. Ord. (5/-)	6/-	6/-
,, 4% 1st Mort. Deb. Red. (£100)	£97	£97
British Cyanides Co., Ltd., Ord. (2/-)	4/-	4/-
British Drug Houses, Ltd. Ord.	**21/3**	**21/3**
,, **5% Cum. Pref.**	**21/10½**	**21/10½**
British Glues and Chemicals, Ltd. Ord. (4/-)	9/6	8/9
,, 8% Pref. (Cum. and Part.)	30/-	29/4½
British Oil and Cake Mills, Ltd. Cum. Pfd. Ord.	48/1½	48/1½
,, 5½% Cum. Pref.	27/6	27/6
,, **4¼% First Mort. Deb. Red. (£100)**	**£107/10/-**	**£107/10/-**
British Oxygen Co., Ltd. Ord.	95/-	95/-
,, **6½% Cum. Pref.**	**32/6**	**32/6**
British Portland Cement Manufacturers, Ltd. Ord.	93/9	91/3
,, 6% Cum. Pref.	29/4½	29/4½
Bryant & May, Ltd. Pref.	**67/6**	**67/6**
Burt, Boulton & Haywood, Ltd. Ord.	21/3	21/3
,, 7% Cum. Pref.	28/9	28/9
,, **6% 1st Mort. Deb. Red. (£100)**	**£102/10/-**	**£102/10/-**

Name.	April 14.	April 7.
Bush, W. J., & Co., Ltd. 5% Cum. Pref. (£5)	108/9	108/9
,, 4% 1st Mort. Deb. Red. (£100)	£94/10/-	£94/10/-
Calico Printers' Association, Ltd. Ord.	**8/1½**	**8/1½**
,, 5% Pref. (Cum.)	11/10½	11/10½
Cellulose Acetate Silk Co., Ltd. Ord.	11/6¾	12/2¼
,, Deferred (1/-)	2/1½	2/1½
Consett Iron Co., Ltd. Ord.	11/9	11/9
,, 8% Pref.	38/9	38/9
,, **6% First Deb. stock, Red.** (£100)	£115/10/-	£115/10/-
Cooper, McDougal & Robertson, Ltd. Ord.	35/-	35/-
,, 7% Cum. Pref.	28/9	28/9
Courtaulds, Ltd. Ord.	50/7½	51/3
,, 5% Cum.	25/7½	25/7½
Crosfield, Joseph, & Sons, Ltd. 5% Cum. Pre-Pref.	25/-	25/-
,, Cum. 6% Pref.	29/4½	28/1½
,, 6½% Cum. Pref.	30/-	30/-
,, 7½% "A" Cum. Pref.	31/10½	31/10½
Distillers Co., Ltd. Ord.	101/-	101/-
,, 6% Pref. Stock Cum.	30/-	30/-
Dorman Long & Co., Ltd. Ord.	28/9	28/9
,, Pref. Ord.	40/-	40/-
,, 6½% Non-Cum. 1st Pref.	25/-	25/-
,, 8% Non-Cum. 2nd Pref.	25/-	25/-
,, 4% First Mort. Perp. Deb. (£100)	£103/10/-	£103/10/-
,, 5% 1st Mort. Red. Deb. (£100)	£106/10/-	£106/10/-
English Velvet & Cord Dyers' Association Ltd. Ord.	3/9	3/9
,, 5% Cum. Pref.	6/3	7/6
,, 4% First Mort. Deb. Red. (£100)	£67/10/-	£67/10/-
Fison, Packard & Prentice, Ltd. Ord.	45/-	45/-
,, 7% Non-Cum. Pref.	31/10½	31/10½
,, **4½% Debs. (Reg.) Red. (£100)**	**£106**	**£106**
Gas Light and Coke Co.	28/-	28/-
,, 3½% Maximum Stock (£100)	£90/10/-	£90/10/-
,, 4% Consolidated Pref. Stock (£100)	£106/10/-	£106/10/-
,, 3% Consolidated Deb. Stock, Irred. (£100)	£89/10/-	£89/10/-
,, 5% Deb. Stock Red. (£100)	£118/10/-	£118/10/-
,, 4½% Red. Deb. Stock (1960-65) (£100)	£115/10/-	£115/10/-
Goodlass Wall & Lead Industries, Ltd. Ord. (10/-)	15/7½	15/7½
,, 7% Prefd. Ord. (10/-)	13/1½	13/1½
,, 7% Cum. Pref.	28/9	28/9

Name.	April 14.	April 7.
Gossage, William, & Sons, Ltd. 5% 1st Cum. Pref.	24/4½	24/4½
,, 6½% Cum. Pref.	28/9	28/9
Imperial Chemical Industries, Ltd. Ord.	40/-	39/6
,, Deferred (10/-)	9/7½	9/7½
,, 7% Cum. Pref.	33/6	33/3
Imperial Smelting Corporation, Ltd. Ord.	17/9	17/9
,, 6½% Pref. (Cum.)	25/7½	25/7½
International Nickel Co. of Canada, Ltd. Cum.	$50⅛	$50¼
Johnson, Matthey & Co., Ltd. 5% Cum. Pref. (£5)	105/-	105/-
,, 4% Mort. Deb. Red. (£100)	£98/10/-	£98/10/-
Laporte, B., Ltd. Ord.	120/-	120/-
Lawes Chemical Co., Ltd. Ord. (10/-)	8/9	8/9
,, 7% Non-Cum. Part Pref. (10/-)	10/-	10/-
Lever Bros., Ltd. 7% Cum., Pref.	33/-	32/6
,, 8% Cum. "A" Pref.	33/9	33/3
,, 20% Cum. Prefd. Ord.	81/3	80/-
,, 5% Cons. Deb. (£100)	£106/10/-	£106/10/-
,, 4% Cons. Deb. (£100)	£104/10/-	£104/10/-
Magadi Soda Co., Ltd. 12½% Pref. Ord. (5/-)	1/3	1/3
,, 6% 2nd Pref. (5/-)	6d.	6d.
,, 6% 1st Debs. (Reg.)	£40	£40
Major & Co., Ltd. Ord. (5/-)	7½d.	7½d.
,, 8% Part. Prefd. Ord. (10/-)	9d.	9d.
,, 7½% Cum. Pref.	1/6¾	1/6¾

Name.	April 14.	April 7.
Pinchin, Johnson & Co., Ltd. Ord. (10/-)	46/6	46/6
,, 1st Pref. 6½% Cum.	32/-	32/-
Potash Syndicate of Germany (Deutsches Kalisyndikat G.m.b.H.) 7% Gld. Ln. Sr. "A" and "B" Rd.	£76	£74
Reckitt & Sons, Ltd. Ord.	115/-	115/-
,, 4½% Cum. 1st Pref.	23/9	24/4½
Salt Union, Ltd. Ord.	45/-	45/-
,, Pref.	48/1½	48/1½
,, 4½% Deb. (£100)	£107/10/-	£107/10/-
South Metropolitan Gas Co. Ord. (£100)	£125/10/-	£124/10/-
,, 6% Irred. Pref. (£100)	£149/10/-	£149/10/-
,, 4% Pref. (Irred.) (£100)	£105/10/-	£105/10/-
,, Perpetual 3% Deb. (£100)	£90/10/-	£90/10/-
,, 5% Red. Deb. 1950-60 (£100)	£115/10/-	£115/10/-
Staveley Coal and Iron Co., Ltd. Ord.	53/9	53/9
Stevenson & Howell, Ltd. 6½% Cum. Pref.	26/3	26/3
Triplex Safety Glass Co., Ltd. Ord. (10/-)	93/1½	91/3
Unilever, Ltd. Ord.	32/6	33/1½
,, 7% Cum. Pref.	30/6	30/3
United Glass Bottle Manufacturers, Ltd. Ord.	45/-	45/-
,, 7½% Cum. Pref.	32/6	32/6
United Molasses Co., Ltd. Ord. (6/8)	23/9	23/9
,, 6% Cum. Pref.	26/3	26/3
United Premier Oil & Cake Co., Ltd. Ord. (5/-)	11/10½	11/10½
,, 7% Cum. Pref.	25/-	25/-
,, 4¾% Deb. Red. (£100)	£104	£104

Inventions in the Chemical Industry

THE following information is prepared from the Official Patents Journal. Printed copies of Specifications accepted may be obtained from the Patent Office, 25 Southampton Buildings, London, W.C.2, at 1s. each. The numbers given under "Applications for Patents" are for reference in all correspondence up to the acceptance of the Complete Specification.

Specifications Open to Public Inspection

SHAPED WASHING AND CLEANSING AGENTS, manufacture and production.—I. G. Farbenindustrie. Oct. 10, 1933. 443,795.

ASSIMILABLE ORGANIC BISMUTH SALTS in oil, production.—D. Gardner. Dec. 13, 1934. 443,860.

AMINES, preparation.—T. H. Böhme, A.-G. March 17, 1934. 443,863.

EMULSIONS OF BITUMEN, resins, waxes or the like.—P. Lechler (trading as P. Lechler (Firm of)). April 1, 1935. 443,666.

CHEMICAL PRODUCTS which may be used as fertilisers, process for manufacture.—P. Lanthier. April 9, 1935. 443,670.

OLEUM, apparatus for manufacture and production.—I. G. Farbenindustrie. May 24, 1934. 443,674.

DRYING OILS, process for manufacturing.—Naamlooze Vennootschap De Bataafsche Petroleum Maatschappij. June 27, 1934. 443,679.

COBALT-TUNGSTEN-CHROMIUM ALLOYS, manufacture.—Heraeus Vacuumschmelze A.-G. July 14, 1934. 443,821.

CRACKING OF RESIDUAL OILS.—Standard Oil Development Co. Nov. 20, 1934. 443,879.

WATER-SOLUBLE CONDENSATION PRODUCTS suitable as assistants in the textile and related industries, manufacture and production. Coutts and Co., and F. Johnson (Legal representatives of J. Y. Johnson (deceased)) (I. G. Farbenindustrie). June 15, 1934. 443,631.

AZO DYESTUFFS.—Imperial Chemical Industries, Ltd., and N. H. Haddock and C. H. Lumsden. June 28, 1934. 443,835.

CATALYTIC OXIDATION OF KETOLS, process.—Naamlooze Vennootschap de Bataafsche Petroleum Maatschappij. Sept. 22, 1934. 25179/35.

Specifications Accepted with Date of Application

ACETALDEHYDE FROM ACETYLENE, manufacture and production.—Coutts and Co., and F. Johnson (Legal representatives of J. Y. Johnson (deceased)) (I. G. Farbenindustrie). Nov. 22, 1934. (Addition to 425,069.) 443,928.

DESTRUCTIVE HYDROGENATION of distillable carbonaceous materials.—International Hydrogenation Patents Co., Ltd. June 23, 1934. 443,937.

WOOD PRESERVATIVES.—Grubenholzimprägnierung Ges. Aug. 3, 1934. 443,995.

MIXED FERTILISERS, process for preparation.—Kali-Chemie A.-G. Sept. 4, 1934. 22804/35.

PLASTIC MASSES, paints and lacquers.—H. Hunsdiecker. Sept. 3, 1934. 23978/35.

UNSATURATED ALIPHATIC OR CYCLOALIPHATIC CARBOXYLIC ACID NITRILES, manufacture and production.—I. G. Farbenindustrie. Sept. 4, 1934. 24566/35.

TREATING CELLULOSE and derivatives thereof, process.—E. I. du Pont de Nemours and Co. Sept. 4, 1934. 24709/35.

CELLULOSE MATERIALS, treatment.—E. I. du Pont de Nemours and Co. Sept. 4, 1934. 24710-1/35.

MORDANT DYESTUFFS, manufacture.—Durand and Huguenin A.-G. Sept. 5, 1934. 24781/35.

GASOL AND ETHYLENE contained in industrial gases, process for rendering commercially useful.—Ruhrchemie A.-G. Sept. 5, 1934. 24799/35.

COMPOSITE SAFETY GLASSES.—Soc. du Verre Triplex. Sept. 7, 1934. 24887/35.

VAT DYESTUFFS of the thioindigo series, manufacture.—I. G. Farbenindustrie. Sept. 8, 1934. 24913/35.

CONVERSION OF OILS, FATS, AND FATTY ACIDS into claidic acid or derivatives thereof, method.—Naamlooze Vennootschap Ned. Research Centrale. Sept. 7, 1934. 24960/35.

CYANINE DYES and of sensitised photographic emulsions, manufacture.—I. G. Farbenindustrie. Sept. 7, 1934. 25051/35.

STRIPPING OF DYES from textile materials.—Imperial Chemical Industries, Ltd., J. G. Evans, and H. A. Piggott. June 12, 1934. 444,169.

COMPOUNDS OF HETEROPOLAR CONSTITUTION of high molecular weight, manufacture.—Deutsche Hydrierwerke A.G. June 15, 1933. 444,239.

SYNTHETIC RESINS, production of articles.—A. Nowack A.G., and Dr. R. Hessen. Aug. 17, 1934. 444,475.

HYGROSCOPIC MATERIAL to be used for the adsorption and retention of moisture in soil, manufacture.—E. W. S. Press, and W. Ruddy. Sept. 12, 1934. 444,182.

Applications for Patents

(March 5 to March 11 inclusive.)

HYDROGENATION of oil shales, etc.—J. G. King. 6919.

STABILISED DERIVATIVES.—Marbo Products Corporation. (United States, March 18, '35.) 7072.

VITAMIN PREPARATIONS, manufacture.—Nyegaard and Co. Aktieselskap. (Norway, Feb. 11.) 6927.

AMMONIUM SULPHATE from gas liquor, production.—P. Parrish. 6936.

TRANS-ANDROSTERONE, ETC., manufacture.—Schering-Kahlbaum, A.-G. (Germany, March 11, 35.) 7407.

GLUE, ETC., manufacture.—D. Shortridge. 6612.

N : N¹-DIALKYLDIPYRAZOLEANTHRONYLS, manufacture.—Soc. of Chemical Industry in Basle. (Switzerland, March 8, '35.) 7025.

OLEFINES, hydration.—Usines de Melle. (France, March 22, '35.) 6690.

CHLORINATED RUBBER, manufacture.—L. W. Weickhardt and Imperial Chemical Industries, Ltd. 7273.

ESTERS OF FORMIC ACID, manufacture.—J. C. Woodhouse and E. I. du Pont de Nemours and Co. 7404.

FLUORINE AND FLUORINE OXYGEN COMPOUNDS of sulphur and phosphorus, manufacture.—A. Carpmael (I. G. Farbenindustrie). 8417.

From Week to Week

THE SEVENTEENTH ANNUAL MEETING AND DINNER of the Chemical Engineering Group will be held next Friday, April 24, at the Waldorf Hotel, London, under the chairmanship of Mr. Stanley Robson. The principal feature of the after-dinner programme will be an address on "Aviation" by Lord Amulree.

THE LABORATORIES AND OFFICES of J. F. Crowley and Partners have been transferred from Great George Street, Westminster, to York Mansions, Broadway, Westminster, S.W.1, owing to the purchase by the Middlesex County Council of the premises at Great George Street.

DURING THE FIRST three months of this year plans were submitted to the Hull Corporation for twenty-nine works extensions and new factories. Many of the extensions are for the engineering industry. Other industries concerned are cod-liver oil refining, welding, dyeing, and drum and canister works.

AN EXHIBITION of apparatus, with lectures and demonstrations, is being held in the Royal Technical College, Glasgow, on April 24 and 25. Among exhibits in the technical chemistry department will be a unique working model of a large sugar mill, a lab-scale sugar refining plant, a continuous distillation unit recently erected and a high pressure plant for the study of gas reactions below 200 atmospheres and 500° C.

THE ROUMANIAN CHEMICAL UNDERTAKING of "Timis" Co., in Timisoare, which hitherto has produced only copper-vitriol outside the cartel, has decided to take up the production of sulphuric acid as well as aniline dyeing materials. In order to buy the necessary machines the capital of the company has been raised from 5,000,000 to 10,000,000 lei.

THE TREASURY, on the recommendation of the Import Advisory Committee, has issued the Import Duties (Drawback) (No. 4) Order, 1936 (S.R. and O. 1936, No. 319), increasing the rate of drawback in respect of castor seed used in the manufacture of castor oil. The increase is consequent upon a rise in the average rate of duty paid on castor seed, and takes effect from April 18. The Order, together with the recommendation of the Advisory Committee, is published by the Stationery Office (Cmd. 5156).

HALF OF A TEN PER CENT. WAGES CUT against which the china clay workers employed by seven Newton Abbot and Kingsteignton firms struck in January, 1933, was restored to them as from the week commencing April 13. In announcing that this was the case, Mr. E. V. Watering, Plymouth district officer of the National Union of Municipal and General Workers, stated that negotiations had been proceeding with the firms concerned ever since the cut was imposed, and the employers recently offered to restore half of it.

THE SHIPMENTS OF CHINA CLAY for March month shows that the business barometer of the industry is still rising and affording considerable satisfaction to the whole community. Though the shipping at Foway was not quite as good as in the corresponding month of 1935, yet on the whole the volume dealt with was greater. The port of Par made an interesting record by shipping over 13,000 tons. Details of business in March is as follows:—Foway, 39,236 tons of china clay, 3,084 tons of china stone, 4,261 tons of ball clay; Par, 12,624 tons of china clay, 874 tons of china stone;Charlestown, 4,767 tons of china clay, 477 tons of china stone; Padstow, 1,569 tons of china clay; Plymouth, 175 tons of china clay; Newham, 41 tons of china clay; By rail, 5,422 tons of china clay; making an aggregate of 72,530 tons—made up in the following sections: 63,834 tons of china clay, 4,435 tons of china stone, and 4,261 tons of ball clay.

THE SITE FOR THE FIRST CHEMICAL FACTORY in the Outer Hebrides was recently marked out on the Boisdale Maghair, east of Arosay Breakwater, in South Uist, on behalf of Cefoil, Ltd., Maidenhead, Berks. Negotiations are at present being conducted for the purchase of land near Tighe-an-Righ pier, suitable for the building of stores, etc. When these are completed, work on the factory will begin. This development is expected to start a new era for the natives of North and South Uist and Benbecula, who were the main sufferers when the kelp industry was killed by the importation of cheaper iodine from Japan. Cefoil, Ltd. have purchased the sea-weed rights in these three islands and propose to use it as the raw material in the manufacture of transparent wrapping paper. Collecting stations will be set up all along the coast. An indirect result of this project will be the immediate building of roads, for which the islanders have been agitating for years, since the county council are anxious to encourage the new industry.

STATE CONTROL OF MINERAL OILS in Germany has been extended to raw coal tar. From July 1, utilisation of coal tar for other than distilling purposes will be forbidden. The object of this order is to increase Germany's production of light oils, thus making her less dependent on imports.

THE IMPORT DUTIES ADVISORY COMMITTEE has received an application for an increase in the import duty on camomile flowers. Representations should be addressed in writing to the Import Duties Advisory Committee not later than May 7.

MEMBERS of the Nottingham Archilles Society visited the New Basford works of Gerard Brothers, Ltd., soap manufacturers, on Good Friday morning. The party, who made a thorough inspection of all the processes of soap-making, had the services of Mr. Crawley and his staff. The visit was made possible by the courtesy of the works manager, Mr. J. Cill.

TWO REMINDERS

BRITISH SUMMER TIME commences at 2 a.m. on Sunday. All clocks should be put forward one hour to-night (Saturday).

LAWN TENNIS.—Entries for the sixth annual CHEMICAL AGE lawn tennis tournament should be sent in without delay. The closing date is May 11.

ARRANGEMENTS HAVE BEEN COMPLETED for the formation of a company with a nominal capital of £3,000,000 to establish a wood pulp paper industry in Tasmania. The immediate cash issue of the company will be £950,000. In the last annual report of Amalgamated Zinc (De Bavey's), Ltd., it was stated that a small sum had been lent by the company to the Tasmanian Paper Proprietary. The final survey of the situation in relation to the establishment of the proposed Australian paper industry was in progress, and it was stated that the board would issue a statement as soon as it was in a position to do so. Amalgamated Zinc (De Bavey's) and Electrolytic Zinc Co., of Australasia, each hold shares in Tasmanian Paper Proprietary, Ltd.

Company News

Babcock and Wilcox.—A final dividend of 4 per cent., less tax, is to be paid on the £4,299,656 of ordinary capital on May 6. This maintains the year's distribution at 8 per cent.

Horace Cory and Co.—The net profits, including a profit of £1,535 on realisation of investments, amount to £5,540. A cumulative dividend of 5¼ per cent. for 1935 is to be paid, but no ordinary dividend is recommended.

International Aluminium Co.—The profit for 1935, after providing for amortisation, renewals and other charges, was £38,715, against £41,286 in the previous year. To this is added £15,113 brought in, making £53,827, after deducting debenture interest, fees, tax and preference dividends, there remains £16,493, which is carried forward.

Cellon, Ltd.—A dividend of 10 per cent., less tax, is announced on the 5s. ordinary shares. It is proposed to write off against the profit for 1935 the new issue expenses incurred in that year, which were reduced by the premium received on the issue of preference shares, the net amount to be provided being £6,500. The reserve account is raised to £25,000 by a transfer of £2,000.

Aluminium Corporation.—The profit for 1935, after providing for depreciation and other charges, amounts to £24,706, and after payment of interest on debenture stock, directors' and trustees' fees, and providing for tax, there is a profit of £8,161 (£4,496), which, deducted from debit balance brought forward amounting to £16,623, reduces debit to be carried forward to £8,461.

British Celanese.—The directors have decided to pay on April 30 on year's dividend on the £2,000,000 of 7 per cent. first preference capital. This will bring dividends up to October 31, 1935. The previous payment was made last January, when six months' arrears were distributed. The dividends on the 7½ per cent. participating second preference shares are paid to April 30, 1930. No payment has yet been made on the £2,211,333 of ordinary capital.

Bryant and May, Ltd.—A final dividend of 15 per cent., tax free, is announced on its ordinary shares, making 25 per cent., tax free, for 1935, the same as in 1934. In the latter year, however, a bonus dividend of £250,000 was distributed, representing £100,000 profit realised on sale of investments and £150,000 from reserve. This bonus was carried by the British Match Corporation, which owns all the ordinary shares, to its reserve account. Dividends are also announced on the 14 per cent. preference shares for the half-year ended March 31, 1936, and a final dividend on partnership shares of 5 per cent., tax free. The employees' proportion of profits is £13,263.

Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for any errors that may occur.

Mortgages and Charges

(NOTE.—The Companies Consolidation Act of 1908 provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every company shall, in making its Annual Summary, specify the total amount of debt due from the company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt as specified in the last available Annual Summary, is also given marked with an *—followed by the date of the Summary, but such total may have been reduced.)

BRITISH COLOUR AND MINING, LTD., Manchester. (M., 18/4/36.) Registered March 30, £210 charge, to Cheltenham and Gloucester Building Society; charged on land and messuage at Milkwall, near Coleford. *£2,000. April 20, 1934.

DIGGORY AND CO., LTD., Liverpool, chemical brokers. (M., 18/4/36.) Registered March 27, mortgage to National Provincial Bank, Ltd., securing all moneys due or to become due to the Bank; charged on Grapes Hotel, Llangollen, etc. *Nil. August 14, 1934.

FOLDAL COPPER AND SULPHUR CO., LTD., London, E.C. (M., 18/4/36.) Registered March 31, debenture securing 150,000 Norwegian Kroner, to Den Norske Statved, Socialdepartmentet, Oslo, Norway; general charge (except stocks of ore for the time being and ores in process of reduction). *£89,200. January 13, 1936.

HOWARD-PRICE, LTD., Lincoln, tar distillers, etc. (M., 18/4/36.) Registered March 26, £2,000 debentures; general charge.

LLOYDS CHEMICAL CO., LTD., Maidenhead. (M., 18/4/36.) Registered March 27, mortgage, to Midland Bank, Ltd., securing all moneys due or to become due to the Bank; charged on Ravenscroft, Braywick Road, Maidenhead, etc. *Nil. December 31, 1934.

Satisfactions

ADAMS WEBSTER AND CO., LTD., London, E., chemical manufacturers. (M.S., 18/4/36.) Satisfactions registered March 31, £500, registered March 20, 1901, and £1,000, part of amount outstanding July 1, 1908.

GOODALL BACKHOUSE AND CO., LTD., Leeds, manufacturing chemists, sauce manufacturers, etc. (M.S., 18/4/36.) Satisfaction registered March 28, £10,000, registered July 27, 1934.

Bill of Sale

McNICOL JNO., 34 Lingwood Gardens, Osterley Park, manufacturing chemist. (B.S., 18/4/36.) Dated March 26. Filed April 1. £40.

County Court Judgments

(NOTE.—The publication of extracts from the "Registry of County Court Judgments" does not imply inability to pay on the part of the persons named. Many of the judgments may have been settled between the parties or paid. Registered judgments are not necessarily for debts. They may be for damages or otherwise, and the result of bona-fide contested actions. But the Registry makes no distinction of the cases. Judgments are not returned to the Registry if satisfied in the Court books within twenty-one days. When a debtor has made arrangements with his creditors we do not report subsequent County Court Judgments against him.)

BEAUCAIRE LABORATORIES (sued as a firm), 14 America Square, E.C., chemists. (C.C., 18/4/36.) £22 17s. 8d. February 3.

Company Winding-up Voluntarily

THE STREAM-LINE FILTER CO., LTD. (C.W.U.V., 18/4/36.) By special resolution April 7 for purpose of reconstruction. Alfred Herbert Matthews, 181 Queen Victoria Street, London, E.C.4, appointed liquidator. All the creditors have been, or will be, paid in full.

Forthcoming Events

LONDON.

April 22.—Institution of Chemical Engineers. "The Design of Vessels to Withstand High Internal Pressure." Dr. D. M. Newitt. 6.30 p.m. Burlington House, Piccadilly, London.

April 23.—The Institute of Chemist-Analysts. "Modern Economic Proposals as an aid to Scientific Progress." Marquis of Tavistock. 7.30 p.m. Royal Society of Arts, John Street, Adelphi, London.

April 23.—Institute of Fuel. "The Technique of Hydrogenation of Coal and its Products." Dr. J. G. King. 6 p.m. Burlington House, Piccadilly, London.

April 24.—Chemical Engineering Group. 17th annual general meeting and dinner. "Aviation." Lord Amulree. 6.45 p.m. Waldorf Hotel, Aldwych, London.

April 25.—Royal Society of Arts. "Problems of Road Research." Reginald E. Stradling. 8 p.m. John Street, Adelphi, London.

BIRMINGHAM.

April 23.—Society of Chemical Industry (Birmingham and Midland Section). "Impact Tests on Laminated Safety Glass." J. Wilson. 7.30 p.m. University Building, Edmund Street, Birmingham.

NEWCASTLE-ON-TYNE.

April 25.—North of England Institute of Mining and Mechanical Engineers. 2.30 p.m. Newcastle-on-Tyne.

SHEFFIELD.

April 22.—Society of Glass Technology. 19th annual general meeting. 2 p.m. The University, Sheffield.

STOKE-ON-TRENT.

April 20.—The Ceramic Society. "Some Researches on China Clays." R. J. Davies, H. F. E. Donnelly and R. A. Green. 7.30 p.m. North Staffordshire Technical College, Stoke-on-Trent.

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